



**US Army Corps
of Engineers®**

RFP No. **W912DW-05-R-0018**

Seattle District

Corrosion Control/AGE Facility, Malmstrom AFB

Montana

Construction Solicitation and Specifications

February 2005

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THIS PROCUREMENT IS:

Open to both Large and Small Business

MALMSTROM AFB, Montana

SITE VISIT:

A one-time site visit will be conducted on 22 February 2005, 2:00 p.m. local Hours, Education Center building 1240, Room 101, Malmstrom Air Force Base, Montana. The meeting will begin with presentation of the solicitation to start promptly at 2:00 p.m. local Hours. Following the presentation a tour of the site will take place. Adjournment is expected by noon. Your arrival at the visitor's center on 2nd Avenue North and 63rd Street South should be by 1:15 p.m. local Hours to assure getting your base pass. You will need a picture ID. All visitors will be transported by government furnished bus to be boarded at the visitor center at 1:45 p.m. local Hours. You are requested to park privately owned vehicles across the street on 63rd Street South and the government will provide transportation to return to the visitor center immediately after the site tour. No special security measures are in force at this time. If you have an active base pass with a base registration for your vehicle you may elect to meet at the Education Center at 2:00 p.m. local Hours.

DIRECTION TO MALMSTROM AFB: From the airport take I-15 North, to the 10th Ave South Exit, following the signs directing traffic to Malmstrom AFB. Turn left on northwest bypass, at light turn right on 2nd Ave South. When entering Malmstrom AFB, park on the west side of the Gate Security building, not in the visitor parking lot. Sign in at the Visitor Center. The bus will depart not later than 1:45 p.m. local time PM.

Offerors are urged and expected to inspect the site where construction is to be performed and to satisfy themselves as to all general and local conditions which may affect the cost of performance of the contract, to the extent, such information is reasonably obtainable. In no event, will a failure to inspect the site constitute grounds for withdrawal of bid after opening or for a claim after award of the contract.

BIDDING DOCUMENTS: Register for solicitations at the Internet site:

<http://www.nws.usace.army.mil/ct/>

PLANHOLDER'S LISTS: Lists may also be obtained from the same site

FOR INQUIRIES, CONTACT THE FOLLOWING INDIVIDUAL Monday through Friday between the hours of 8:00 a.m. and 3:30 p.m.:

ADMINISTRATIVE MATTERS:

Sherrye Schmahl 206-764-6588 Sherrye.L.Schmahl@nws02.usace.army.mil

For Technical Matters, questions must be submitted via the internet on the ProjNet Bid Inquiry website www.projnet.org. To submit inquiries, Bidders will need to enter their email address and the Bid Inquiry Key, shown below. A password is not required.

After entering the website, click the Bid tab at top and select Bidder Inquiry. At Bid Inquiry Login page, enter USACE (Agency), enter Key (shown below), and your email address. Click Login. At Create Account page, Bidders need to complete the form only once to create their user accounts. Once a user account is established, Bidders will only need to enter their email address and the Bid Inquiry Key to submit technical inquiries.

After the user account is created, the Select Option page allows Bidders to Post A New Inquiry or View Inquiries. Bidders will receive an email acknowledgement of their question, followed by an email when their question has been answered. Bidder must enter the website to view the actual answer to their question. All submitted questions and responses are viewable to all Bidders at this website.

Bid Inquiry Key 213DDG-1AAHFC

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<u>SECTION</u>	<u>TITLE</u>
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SF1442 - Pages 00010-1 thru 00010-5 (00010-3 is reserved for use at a later time) & Subcontracting Plan if applicable, Pages 00010-6 thru 00010-13	
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00100	Bidding Schedule/Instructions to Bidders
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00110	Proposal Submission and Evaluations
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00600	Representations and Certifications and other Statements of Offerors, and Pre-Award Information
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00700	Contract Clauses
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00800	Special Clauses, which include the following:
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a) Special Clauses	Pages 00800-1 thru <u>00800-12</u>
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b) Davis-Bacon General Wage Decision No.	<u>MT20030005</u>
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01000	Technical Specifications
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01001 thru	<u>16815</u>
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RETURN THE FOLLOWING WITH YOUR PROPOSAL:

SF1442 - Pages 00010-1 thru 00010-5 (00010-3 is reserved for use at a later time)

Section 00600 - Representations and Certifications and Pre-Award Information

20% Bid Bond

*Additionally, if you are a large business you will be required to submit a "Small Business and Small Disadvantaged Business Subcontracting Plan," with your proposal.

** BONDS – Matter of All Seasons Construction, Inc. GAO Decision B-291166.2

Bid Bonds must be accompanied by a Power of Attorney containing an original signature from the surety, which must be affixed to the Power of Attorney after the Power of Attorney has been generated. Computer generated and signed Power's of Attorney will only be accepted if accompanied by an original certification from a current officer of the surety attesting to its authenticity and continuing validity.

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!!! CAUTION TO OFFERORS !!!

1. **TELEPHONES:** Limited telephone service is provided in the lobby. Only two public telephones may be used by offerors for completing bids.

2. **BUSINESS HOURS:** For the Seattle District Corps of Engineers are from 7:30 A.M. to 4:00 P.M., Monday through Friday.

BEFORE SIGNING AND MAILING THIS OFFER, PLEASE TAKE NOTE OF THE FOLLOWING, AS FAILURE TO PERFORM ANY ONE OF THESE ACTIONS MAY CAUSE YOUR OFFER TO BE REJECTED

3. **AMENDMENTS:** Have you acknowledged receipt of **ALL** amendments? If in doubt as to the number of amendments issued, please contact the representative listed on the Information Page.

4. **AMENDED BID PAGES:** If any of the amendments furnished amended offer pages, **the amended offer pages must be used** in submitting your offer.

5. **BID GUARANTEE:** Sufficient bid guarantee in proper form must be furnished **with your offer**. (FOR JOBS EXCEEDING \$25,000) See section 00700, FAR 52.228-1

6. **INDIVIDUAL SURETIES:** Please note requirements for Individual Sureties in Section 00100, FAR 52.228-4003.

7. **MISTAKE IN OFFER:** Have you reviewed your offer price for possible errors in calculation or work left out?

8. **TELEGRAPHIC MODIFICATIONS:** The Seattle District does not have the capability of receiving commercial telegrams directly. Offerors who wish to modify their offer by telegram are urged to ensure that telegrams are submitted within enough time to arrive at the designated location. Any doubt as to time should be resolved in favor of **EXTRA TIME**. Transmission by Fax to this office is **NOT ACCEPTABLE**.


9. **OFFER ACCEPTANCE PERIOD:** The minimum offer acceptance period is specified in block 13D of SF1442 (page 00010-1), Solicitation, Offer and Award. Please ensure that you allow at least the stated number of calendar days for the Government to accept your offer.

10. **RFP RESULTS:** A Request for Proposal is a negotiated procurement. As such, offer results are not available on the web. Participants will be notified via letter as to the status of their offer.

11. **CENTRAL CONTRACTOR REGISTRATION:** Per FAR Clause 52.204-7, CENTRAL CONTRACTOR REGISTRATION (OCT 2003), in Section 00700, registration is required prior to award of any contract from a Solicitation issued after May 31, 1998. If the Offeror does not become registered in the CCR database in the time prescribed by the Contracting Officer, the Contracting Officer will proceed to award to the next otherwise successful registered Offeror.

Offerors and Contractors may obtain information on registration and annual confirmation requirements via the internet at <http://www.ccr.gov> or by calling 1-888-227-2423, or 269-961-5757.

12. HUBZONE CERTIFICATION: Per FAR Clause 52.219-4, NOTICE OF PRICE EVALUATION PREFERENCE FOR HUBZONE SMALL BUSINESS CONCERNS (Oct 04) in Section 00700. A HUBZone small business concern, as used in this clause, means a small business concern that appears on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration Reference: <https://el.sba.gov:90000/prodhubzone/hubzone/approval.st>.

SOLICITATION, OFFER, AND AWARD <i>(Construction, Alteration, or Repair)</i>	1. SOLICITATION NUMBER W912DW-05-R-0018	2. TYPE OF SOLICITATION <input type="checkbox"/> SEALED BID (IFB) <input checked="" type="checkbox"/> NEGOTIATED (RFP)	3. DATE ISSUED 14 February 2005	PAGE OF PAGES 1
	IMPORTANT - The "offer" section on the reverse must be fully completed by the offeror.			
4. CONTRACT NUMBER	5. REQUISITION/PURCHASE REQUEST NUMBER W68MD9-5018-9272	6. PROJECT NUMBER		
7. ISSUED BY Seattle District, Corps of Engineers ATTN: CENWS-CT-CB PO Box 3755 Seattle, WA 98124-3755	CODE W912DW	8. ADDRESS OFFER TO Seattle District, Corps of Engineers PO Box 3755 ATTN: CENWS-CT-CB Seattle, WA 98124-3755 HAND CARRY: Seattle District Corps of Engineers Contracting Division 4735 East Marginal Way South Seattle, WA 98134-2329		
9. FOR INFORMATION CALL 	A. NAME Sherrye L. Schmahl	B. TELEPHONE NUMBER (Include area code) (NO COLLECT CALLS) 206-764-6588		

SOLICITATION

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS (Title, identifying number, date):

Furnish all labor, materials and equipment and perform all work for Corrosion Control/AGE Facility, Malmstrom AFB, Montana in accordance with the attached Contract Clauses, Special Clauses, Technical Specifications and Drawings.

11. The Contractor shall begin performance within <u>10</u> calendar days and complete it _____ calendar days after <input type="checkbox"/> award, <input checked="" type="checkbox"/> notice to proceed. This performance period is <input checked="" type="checkbox"/> mandatory, <input type="checkbox"/> negotiable. (See * Paragraph SC-5, 00800 .)	
12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE PAYMENT BONDS? (If "YES," indicate within how many calendar days after award in Item 12B.) <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	12B. CALENDAR DAYS 10
13. ADDITIONAL SOLICITATION REQUIREMENTS:	
A. Sealed offers in original and <u>4</u> copies to perform the work required are due at the place specified in Item 8 <u>2:00 p.m.</u> (hour) local time <u>16 March 2005</u> (date). If this is a sealed bid solicitation, offers will be publicly opened at that time. Sealed containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.	
B. An offer guarantee <input checked="" type="checkbox"/> is, <input type="checkbox"/> is not required.	
C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by	
D. Offers providing less than <u>120</u> calendar days for Government acceptance after the date offers are due will not be considered and w be rejected.	

OFFER (Must be fully completed by offeror)

14. NAME AND ADDRESS OF OFFEROR (Include ZIP Code)

15. TELEPHONE NUMBER (Include area code)

Fax No.:

16. REMITTANCE ADDRESS (Include only if different than Item 14)

Tax ID No:
eMail:

DUNS No:

CODE

FACILITY CODE

17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation, if this offer accepted by the Government in writing within _____ calendar days after the date offers are due. (Insert any number equal or greater than the minimum requirement stated in 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.)

AMOUNTS



See Page 00010-5

18. The offeror agrees to furnish any required performance and payment bonds.

19. ACKNOWLEDGEMENT OF AMENDMENTS

(The offeror acknowledges receipt of amendments to the solicitation - give number and date of each)

AMENDMENT NO.										
DATE										

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER (Type or print)

20B. SIGNATURE

20C. OFFER DATE

AWARD (To be completed by Government)

21. ITEMS ACCEPTED

22. AMOUNT

23. ACCOUNTING AND APPROPRIATION DATA

24. SUBMIT INVOICES TO ADDRESS SHOWN IN
(4 copies unless otherwise specified)

ITEM

26

25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO

☐ 10 U.S.C. 2304(c) ()☐ 41 U.S.C. 253(c) ()

26. ADMINISTERED BY

CODE

27. PAYMENT WILL BE MADE BY

USACE - Seattle District
Northwest Area Office
PO Box 92146
Tillicum, WA 98492-0146US Army Corps of Engineers Finance Center
CEFC-AO-P
5722 Integrity Drive
Millington, TN 38054-500**CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE**

☐ 28. NEGOTIATED AGREEMENT (Contractor is required to sign this document and return _____ copies to the issuing office.) Contractor agrees to furnish and deliver all items or perform all work requirements identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications incorporated by reference in or attached to this contract.

☐ 29. AWARD. (Contractor is not required to sign this document.) You offer on this solicitation is hereby accepted as to the items listed. The award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.

30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN
(Type or print)

31A. NAME OF CONTRACTING OFFICER (Type or print)

ROSE N.S. OLDS

30B. SIGNATURE

30C. DATE

31B. UNITED STATES OF AMERICA

31C. AWARD DATE

BY

IF THE CONTRACTOR IS A CORPORATION OR PARTNERSHIP, THE APPLICABLE PORTION OF THE FORM LISTED BELOW MUST BE COMPLETED. IN THE ALTERNATIVE, OTHER EVIDENCE MUST BE SUBMITTED TO SUBSTANTIATE THE AUTHORITY OF THE PERSON SIGNING THE CONTRACT. IF A CORPORATION, **THE SAME OFFICER SHALL NOT EXECUTE BOTH THE CONTRACT AND THE CERTIFICATE.**

CORPORATE CERTIFICATE

I, _____, certify that I am the _____
Secretary of the Corporation named as Contractor herein; that _____, who signed
this contract on behalf of the Contractor was then _____ of said corporation; that said
contract was duly signed for and on behalf of said corporation by authority of its governing body and is within the
scope of its corporate powers.

(Secretary) (CORPORATE SEAL)

AUTHORITY TO BIND PARTNERSHIP

This is to certify that the names, signatures and Social Security Numbers of all partners are listed below and that the person signing the contract has authority actually to bind the partnership pursuant to its partnership agreements. Each of the partners individually has full authority to enter into and execute contractual instruments on behalf of said partnership with the United States of America, except as follows: (state "none" or describe limitations, if any) _____

This authority shall remain in full force and effect until such time as the revocation of authority by any cause whatsoever has been furnished in writing to, and acknowledged by, the Contracting Officer.

(Names, Signatures and Social Security Numbers of all Partners)

NAME	SIGNATURE	SOCIAL SECURITY NO.
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

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SCHEDULE

<u>Item No.</u>	<u>Description of Item</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
BASE ITEMS					
0001	All Work for Corrosion Control / AGE Facility, Except for Items 0002, 0003, 0004 and 0005	1	JOB	L.S.	\$_____
					—
0002	All Work for HAZMAT Contractor Authorization Procedures, as Specified in Section 01355, Except that Work Described in Paragraph 3.5.1.4 is part of the Base Bid Item 0001	1	JOB	L.S.	\$_____
					—
0003	All Work for As-Built Drawings as specified in Section 01702 from preparation to final approval	1	JOB	L.S.	\$25,000.00
0004	All Work for O&M Manuals as as specified in Section 01701 from preparation to final approval	1	JOB	L.S.	\$60,000.00
0005	All Work for Form 1354 Checklist and Equipment in Place List as specified in Sections 01704 and 01705 from preparation to final approval	1	JOB	L.S.	\$12,000.00
TOTAL					\$_____
					—

NOTE: The dollar amounts established in Items No. 0003, 0004, and 0005 shall not be revised by bidders.”

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REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

Contracting Division

SUBJECT: W912DW-05-R-0018, Corrosion Control facility/AGE, Malmstrom AFB, Montana

NOTICE TO LARGE BUSINESS FIRMS: (RFP)

Your attention is directed to the contract clauses entitled "Utilization of Small Business Concerns (Oct 2000) (52.219-8) and "Small Business Subcontracting Plan" (Jan 2002) (52.219-9, Alt II), which are included in this solicitation. If you are a large business, and your offer is **\$1,000,000** or more you are required to submit a subcontracting plan **with** your proposal. Award will not be made under this solicitation without a subcontracting plan approved by the Contracting Officer.

As described in the FEDBIZOPS notification, we consider the following goals reasonable and achievable during the performance of the contract resulting from this solicitation. However, final goals will be negotiated prior to contract award. The Subcontracting Plan will then become a material part of your contract.

- a. 70% of planned subcontracting dollars can be placed with all small business concerns.
- b. 10% of planned subcontracting dollars can be placed with those small business concerns owned and controlled by socially and economically disadvantaged individuals or Historically Black Colleges and Universities or Minority Institutions. NOTE: b. is a subset of a.
- c. 10% of planned subcontracting dollars for small women-owned businesses. NOTE: c. is a subset of a. Also, the women-owned business may meet the definition of a small disadvantaged business. If so, c. will also be a subset of b. (Count firm in all applicable areas.)
- d. 3% of planned subcontracting dollars may be placed with HUBZone small business concerns. NOTE: d. is a subset of a. Note: A HUBZone firm may also be SDB, women-owned and/or veteran-owned. Count firm in all applicable areas).
- e. 3% of planned subcontracting dollars for veteran-owned small business. NOTE: e. is a subset of a. Go to <http://www.va.gov/osdbu/vetctr.htm> or <http://www.sba.gov/VETS/> for questions concerning the Veterans Business Development program.
- f. 3% of planned subcontracting dollars may be placed with service-disabled veteran-owned small business. NOTE: f. is a subset of a. and e.

Goals included in any proposed plan submitted by you should be at least equal to the ones we are recommending. If lesser goals are proposed, you will have to explain how those goals and your plan represent your best efforts to comply with the policy outlined in the contract clauses. There are a number of equally important aspects of the plan. You should familiarize yourself with the requirements set forth in the contract clauses relating to the subcontracting plan before submitting a proposal.

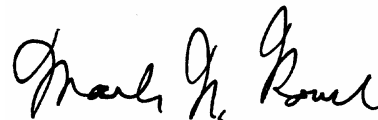
Your plan will be reviewed and scored in accordance with AFARS Appendix DD to ensure it clearly represents your firm's ability to carry out the terms and conditions set forth in the contract clauses. A Subcontracting Plan with a score of less than 70 may not be accepted. It is recommended that you use the enclosed example as a guide to assist you in developing your own subcontracting plan/program. The example is intended to assist you in developing your own subcontracting plan/program. Delete the instructions shown in parenthesis or your plan for subcontracting to small business will not be approved. If discussions during the evaluation of your subcontracting program raises doubts as to your intentions or ability to comply with FAR clause 52.219-9 it could result in your ineligibility for award.

Your plan must address how you will maximize subcontracting opportunities with the small business communities to be found within the project location. Demonstrated outreach efforts through conference attendance, use of the Central Contractor Registration (CCR) Dynamic Small Business Search, corporate support of your Small Business Program Liaison Officer and Small Business Program must be addressed in your subcontracting plan.

Your Small Business Program Managers' attendance at DOD Regional Council Meetings for Small Business Education and Advocacy will be a contract requirement. **DOD Policy Guidance:** In accordance with the Small Business Act, it is the policy of the federal government to aid, assist, and counsel small business to ensure that a fair share of contracts are awarded to small business. Consistent with this, it is the policy of DOD to sponsor regional councils as one significant way to aid, assist, and counsel large business through education and advocacy *of its members who are charged with the responsibility of fulfilling this federal policy.* Therefore, be advised that the individual listed in paragraph 7 of the example will be required to attend these regional council meetings and that attendance must be addressed in your subcontracting plan. Your plan must be submitted with your price proposal.

Should you have any questions or need assistance in DEVELOPING YOUR SUBCONTRACTING PLAN please call Sherrye Schmahl at (206) 764-6588

Sincerely,

A handwritten signature in black ink, appearing to read "Mark N. Roush".

Mark N. Roush
Director of Small and Disadvantaged Business Utilization
Seattle District, U.S. Army Corps of Engineers

Enclosure

NOTE: This is an example plan. You may use this example as a guide in developing your own Small Business Program. Delete all the instructions (parenthesis), including this message, or your plan will be returned.

SMALL BUSINESS SUBCONTRACTING PLAN

DATE:

CONTRACTOR:

ADDRESS:

PHONE NO:

PROJECT TITLE:

SOLICITATION NO:

1. In accordance with the contract clauses at 52.219-8 and 52.219-9, (name of contractor) submits the following Subcontracting Plan for Small, Small Disadvantaged, and Women-owned Business Concerns.

2. Corresponding dollar values for percentages cited in para. 3 for the base period only:

- a. Total contract amount is \$_____.
- b. Total dollars planned to be subcontracted (to all types of businesses): \$_____.
- c. Total dollars planned to be subcontracted to small business concerns (including 2d, 2e, 2f, 2g, and 2h below): \$_____.
- d. Total dollars planned to be subcontracted to small disadvantaged business concerns: \$_____.
- e. Total dollars planned to be subcontracted to small woman-owned business concerns: \$_____.
- f. Total dollars planned to be subcontracted to HUBZone small business: \$_____.
- g. Total dollars planned to be subcontracted to veteran-owned small business concerns \$_____.
- h. Total dollars planned to be subcontracted to service-disabled veteran-owned small business concerns. \$_____.

3. The following percentage goals (expressed in terms of a percentage of total planned subcontracting dollars) are applicable to the contract awarded under the solicitation cited above.

- a. Small Business Concerns (2c divided by 2b): _____% of total planned subcontracting dollars under this contract will go to subcontractors who are small business concerns including 3c through 3e.
- b. Small Disadvantaged Business Concerns (2g divided by 2b): _____% of total planned subcontracting dollars under this contract will go to subcontractors who are small disadvantaged individuals. **(NOTE: SDB firms must be certified by SBA and meet the definition under clause 52.219-8(c)(3)).**

c. Small Woman-Owned Business Concerns (2h divided by 2b): _____% of total planned subcontracting dollars under this contract will go to subcontractors who are small woman-owned businesses

d. Small HUBZone Business Concerns (2f divided by 2b): _____% of total planned subcontracting dollars under this contract will go to subcontractors who are HUBZone small business contractors. (SEE the definition in contract clause 52.219-8(c) or use the internet: <http://www.sba.gov/hubzone/> for further information.)

e. Veteran-owned small business concerns (2d divided by 2b): _____% of total planned subcontracting dollars under this contract will go to subcontractors who are veteran-owned small business.

f. Service-disabled veteran-owned small business concerns (2e divided by 2b): _____% of total planned subcontracting dollars under this contract will go to subcontractors who are service-disabled veteran-owned small business.

4. The principal items or areas we will subcontract under this contract are:

a. Of the items or areas stated in 4; the following are planned to be subcontracted to Small Businesses (LIST THE NAME AND RESPONSIBILITY OF FIRM):

b. Of the items or areas stated in 4.a; the following are planned to be subcontracted to Small Disadvantaged Businesses (LIST THE NAME AND RESPONSIBILITY OF FIRM):

c. Of the items or areas stated in 4.a; the following are planned to be subcontracted to Small Women-Owned Businesses (LIST THE NAME AND RESPONSIBILITY OF FIRM):

d. Of the items or areas stated in 4.a; the following are planned to be subcontracted to HUBZone small business concerns (LIST THE NAME AND RESPONSIBILITY OF FIRM):

e. Of the items or areas stated in 4.a; the following are planned to be subcontracted to Veteran owned Small Business concerns (LIST THE NAME AND RESPONSIBILITY OF FIRM):

f. Of the items or areas stated in 4.a; the following are planned to be subcontracted to Service disabled veteran-owned small business concerns (LIST THE NAME AND RESPONSIBILITY OF FIRM):

****NOTE: SEE LAST PAGE IF THIS SOLICITATION HAS OPTION YEARS
OR PERIODS (DELETE THIS STATEMENT FROM YOUR PLAN)****

5. Provide a description of the method your firm used to develop the subcontracting goals in paragraph 3:

6. Indirect costs were () were not () used in establishing subcontracting goals. **If indirect costs are include in your goals, furnish a description of the method used to determine the proportionate share of indirect costs to be incurred with (i) small business concerns (ii) small disadvantaged business concerns (iii) women-owned small business concerns (iv) HUBZone small business concerns (v) Veteran-owned small business concerns and (vi) Service-disabled veteran-owned concerns **

7. The following individual will administer (name of contractor) Subcontracting Program:
(NOTE TO OFFERORS: The individual named here will be expected to perform and manage your plan and contract clause 52.219-9). Site Construction project managers may not be acceptable as your small business advocate that manages your Corporate Small Business Program).

Name: _____ Job Title: _____

Address and Telephone Number: _____

This individual's specific duties with regard to the conduct of our firm's Subcontracting Plan will include, but will not be limited to, the following:

a. Developing and maintaining bidders lists of small business, HUBZone small business, small disadvantaged business and women-owned small business concerns using sources such as the CCR Dynamic Small Business Search (<http://www.ccr.gov/>), State Offices of Minority and Women-owned Business Enterprises, Business Development Agency, US Department of Commerce, Local Minority Business Development Centers, Economic Development Centers, and National Center for American Indian Enterprise Development.

b. Assuring the inclusion of small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns in all solicitations for products or services which they are capable of providing; and ensuring that all solicitations are structured to permit the maximum possible participation by small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns.

c. Establishing and maintaining records of all solicitations and subcontract awards to ensure that the members of the firm who review bidders proposals documents their reasons for selecting or not selecting a bid submitted by a small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns.

d. Preparing and submitting the Subcontracting Report for Individual Contracts (SF 294) and the Summary Subcontract Report (SF 295) in accordance with instructions provided, and coordinating and preparing for all compliance reviews by Federal agencies.

e. Attendance at DOD sponsored training programs in order to develop guidance and training to firm personnel on the policy of the federal government to aid, assist, and counsel small business under this and other government contracts.

f. Conducting or arranging for all other activities necessary to further the intent and attainment of the goals in the Plan to include motivational training of the firm's purchasing personnel, attendance at workshops, seminars and trade fairs conducted by or on behalf of small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns.

8. The following steps will be taken to ensure that small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns receive notice of and have an equitable opportunity to compete for intended awards of subcontracts and/or purchase orders for the products and/or services describe in paragraph 4 above:

a. Sources will be requested through the CCR Dynamic Small Business Search, business developer organizations, minority and small business trade associations and at small, minority, veteran small business and women-owned small business procurement conferences; sources will be contacted; and bidding materials will be provided to all responding parties expressing an interest.

b. Internally, motivational training will be conducted to guide and encourage purchasing personnel; source lists and guides to small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns will be maintained and utilized by purchasing personnel while soliciting subcontracts and purchase orders; activities will be monitored to ensure sufficient time is allowed for interested bidders to prepare their proposals and to evaluate continuing compliance with the Subcontracting Plan.

9. [Name of contractor] agrees that the clause entitled "Utilization of Small Business Concerns" (Oct 2000) will be included in all subcontracts that offer further subcontracting opportunities. All subcontractors, except small business concerns, who receive subcontracts in excess of \$500,000 (\$1,000,000 in the case of construction) will be required to adopt a subcontracting plan that complies with the requirements of this clause. Such plans will be reviewed to assure that all minimum requirements of an acceptable subcontracting plan have been satisfied.

10. (Name of contractor) agrees to submit such periodic reports and cooperate in any studies or surveys as may be required by the Contracting agency or Small Business Administration in order to determine the extent of compliance by the offeror with the subcontracting plan and with the clause entitled "Utilization of Small Business Concerns" contained in the contract.

11. (Name of Contractor) agrees to maintain at least the following types of records to document compliance with the Subcontracting Plan:

a. The names of all organizations, agencies, and associations contacted for small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns along with records of attendance at conferences, seminars and trade fairs where additional sources were developed.

b. Source lists, guides, and other data identifying small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns.

c. Records on all subcontract solicitations resulting in an award of more than \$100,000 on a contract-by-contract basis, indicating (1) whether small business concerns were solicited, and if not, why not; (2) whether veteran-owned small business concerns were solicited, and if not, why not; (3) whether service-disabled veteran-owned small business concerns were solicited, and if not, why not; (4) whether HUBZone small business were solicited, and if not, why not; (5) whether small disadvantaged business concerns were solicited, and if not, why not; and (6) whether small women-owned business concerns were solicited, and if not, why not; and (7) reasons for the failure of solicited small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small business concerns, HUBZone small business concerns, small disadvantaged business concerns, and women-owned small business concerns to receive a subcontract award.

d. Records of all subcontract award data to include subcontractor's name and address, to be kept on a contract-by-contract basis.

e. Minutes of internal motivational and training meetings held for the guidance and encouragement of purchasing personnel, and records of all monitoring activities performed for compliance evaluation.

f. Copies of SF 294 and SF 295 showing date and place of filing and copies of all other report or results of reviews conducted by the contracting agency or other interested agencies of the Federal government to monitor our compliance with this Subcontracting Plan.

12. (Name of Contractor) will submit a SF 295, Summary Subcontract Report, on Corps of Engineers projects only. The SF 295 shall be completed and distributed in accordance with the Corps of Engineers Supplemental Instructions. (Name of Contractor) will not report Corps of Engineers projects through any other Agency unless authorized by the Contracting Officer.

13. In closing, (Name of contractor) states that it will be the policy of (Name of contractor) to afford every practicable opportunity for small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns to participate in contracts awarded to (Name of contractor) by the Federal Government, to ensure that equitable opportunity is provided small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns to compete for award of subcontracts and purchase orders, and to diligently pursue the achievement of our goals of participation by small business concerns, small disadvantaged business concerns, women-owned small business concerns, HUBZone small business concerns, veteran-owned small business concerns and service-disabled veteran-owned small business concerns in the dollars available for subcontract/purchase order awards under this contract.

BY: _____

DATE: _____

Signature and Title of CEO
Company Name

NOTE: If this solicitation has options (or option periods) , the plan must contain separate goals for **each** option or option period (year). EXAMPLE:

	<u>Dollars</u>	<u>Percentage</u>
1. Optional Yr _____ total:	\$ _____	_____
2. Total to be subcontracted to all types of businesses:	\$ _____	_____
a. Subcontracted to Small Business (including b, c, d, e, and f below):	\$ _____	_____
b. Subcontracted to Small Disadvantaged Businesses:	\$ _____	_____
c. Subcontracted to Women-Owned Small Businesses:	\$ _____	_____
d. Subcontracted to HUBZone concerns	\$ _____	_____
e. Subcontracted to Veteran-owned Small Business:	\$ _____	_____
f. Subcontracted to Service-disabled Veteran-owned Small Business	\$ _____	_____

1. Optional Yr _____ total:	\$ _____	_____
2. Total to be subcontracted to all types of businesses:	\$ _____	_____
a. Subcontracted to Small Business (including b, c, d, e, and f below):	\$ _____	_____
b. Subcontracted to Small Disadvantaged Businesses:	\$ _____	_____
c. Subcontracted to Women-Owned Small Businesses:	\$ _____	_____
d. Subcontracted to HUBZone concerns	\$ _____	_____
e. Subcontracted to Veteran-owned Small Business:	\$ _____	_____
f. Subcontracted to Service-disabled Veteran-owned Small Business	\$ _____	_____

Section 00100 - Bidding Schedule/Instructions to Bidders

52.204-6	Data Universal Numbering System (DUNS) Number	OCT 2003
52.214-34	Submission Of Offers In The English Language	APR 1991
52.214-35	Submission Of Offers In U.S. Currency	APR 1991
52.215-1	Instructions to Offerors --Competitive Acquisition	JAN 2004
52.216-1	Type Of Contract	APR 1984
52.217-5	Evaluation Of Options	JUL 1990
52.219-24	Small Disadvantaged Business Participation Program--Targets	OCT 2000
52.228-1	Bid Guarantee	SEP 1996
52.232-13	Notice Of Progress Payments	APR 1984
52.233-2	Service Of Protest	AUG 1996
52.236-28	Preparation of Proposals --Construction	OCT 1997
52.214-4022	Basis of Award	DEC 1999
52.214-5000	Apparent Clerical Mistakes	MAY 1999
52.228-4001	Information Regarding Performance and Payment Bonds (FAR 28.102)	FEB 2001
52.228-4003	Individual Sureties	DEC 1999
52.236-4902	Magnitude of Construction	DEC 1999

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52.204-6 DATA UNIVERSAL NUMBERING SYSTEM (DUNS) NUMBER (OCT 2003)

(a) The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation "DUNS" or "DUNS+4" followed by the DUNS number or "DUNS+4" that identifies the offeror's name and address exactly as stated in the offer. The DUNS number is a nine-digit number assigned by Dun and Bradstreet, Inc. The DUNS+4 is the DUNS number plus a 4-character suffix that may be assigned at the discretion of the offeror to establish additional CCR records for identifying alternative Electronic Funds Transfer (EFT) accounts (see Subpart 32.11) for the same parent concern.

(b) If the offeror does not have a DUNS number, it should contact Dun and Bradstreet directly to obtain one.

(1) An offeror may obtain a DUNS number--

(i) If located within the United States, by calling Dun and Bradstreet at 1-866-705-5711 or via the Internet at <http://www.dnb.com>; or

(ii) If located outside the United States, by contacting the local Dun and Bradstreet office.

(2) The offeror should be prepared to provide the following information:

(i) Company legal business name.

(ii) Tradestyle, doing business, or other name by which your entity is commonly recognized.

(iii) Company physical street address, city, state and Zip Code.

- (iv) Company mailing address, city, state and Zip Code (if separate from physical).
 - (v) Company telephone number.
 - (vi) Date the company was started.
 - (vii) Number of employees at your location.
 - (viii) Chief executive officer/key manager.
 - (ix) Line of business (industry).
 - (x) Company Headquarters name and address (reporting relationship within your entity).
- (End of provision)

52.214-34 SUBMISSION OF OFFERS IN THE ENGLISH LANGUAGE (APR 1991)

Offers submitted in response to this solicitation shall be in the English language. Offers received in other than English shall be rejected.

(End of provision)

52.214-35 SUBMISSION OF OFFERS IN U.S. CURRENCY (APR 1991)

Offers submitted in response to this solicitation shall be in terms of U.S. dollars. Offers received in other than U.S. dollars shall be rejected.

(End of provision)

52.215-1 INSTRUCTIONS TO OFFERORS--COMPETITIVE ACQUISITION (JAN 2004)

(a) Definitions. As used in this provision--

“Discussions” are negotiations that occur after establishment of the competitive range that may, at the Contracting Officer's discretion, result in the offeror being allowed to revise its proposal.

“In writing or written” means any worded or numbered expression which can be read, reproduced, and later communicated, and includes electronically transmitted and stored information.

“Proposal modification” is a change made to a proposal before the solicitation's closing date and time, or made in response to an amendment, or made to correct a mistake at any time before award.

“Proposal revision” is a change to a proposal made after the solicitation closing date, at the request of or as allowed by a Contracting Officer as the result of negotiations.

“Time”, if stated as a number of days, is calculated using calendar days, unless otherwise specified, and will include Saturdays, Sundays, and legal holidays. However, if the last day falls on a Saturday, Sunday, or legal holiday, then

the period shall include the next working day.

(b) Amendments to solicitations. If this solicitation is amended, all terms and conditions that are not amended remain unchanged. Offerors shall acknowledge receipt of any amendment to this solicitation by the date and time specified in the amendment(s).

(c) Submission, modification, revision, and withdrawal of proposals. (1) Unless other methods (e.g., electronic commerce or facsimile) are permitted in the solicitation, proposals and modifications to proposals shall be submitted in paper media in sealed envelopes or packages (i) addressed to the office specified in the solicitation, and (ii) showing the time and date specified for receipt, the solicitation number, and the name and address of the offeror. Offerors using commercial carriers should ensure that the proposal is marked on the outermost wrapper with the information in paragraphs (c)(1)(i) and (c)(1)(ii) of this provision.

(2) The first page of the proposal must show--

(i) The solicitation number;

(ii) The name, address, and telephone and facsimile numbers of the offeror (and electronic address if available);

(iii) A statement specifying the extent of agreement with all terms, conditions, and provisions included in the solicitation and agreement to furnish any or all items upon which prices are offered at the price set opposite each item;

(iv) Names, titles, and telephone and facsimile numbers (and electronic addresses if available) of persons authorized to negotiate on the offeror's behalf with the Government in connection with this solicitation; and

(v) Name, title, and signature of person authorized to sign the proposal. Proposals signed by an agent shall be accompanied by evidence of that agent's authority, unless that evidence has been previously furnished to the issuing office.

(3) Submission, modification, or revision, of proposals.

(i) Offerors are responsible for submitting proposals, and any modifications, or revisions, so as to reach the Government office designated in the solicitation by the time specified in the solicitation. If no time is specified in the solicitation, the time for receipt is 4:30 p.m., local time, for the designated Government office on the date that proposal or revision is due.

(ii)(A) Any proposal, modification, or revision received at the Government office designated in the solicitation after the exact time specified for receipt of offers is "late" and will not be considered unless it is received before award is made, the Contracting Officer determines that accepting the late offer would not unduly delay the acquisition; and--

(1) If it was transmitted through an electronic commerce method authorized by the solicitation, it was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of proposals; or

(2) There is acceptable evidence to establish that it was received at the Government installation designated for receipt of offers and was under the Government's control prior to the time set for receipt of offers; or

(3) It is the only proposal received.

(B) However, a late modification of an otherwise successful proposal that makes its terms more favorable to the Government, will be considered at any time it is received and may be accepted.

(iii) Acceptable evidence to establish the time of receipt at the Government installation includes the time/date stamp of that installation on the proposal wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel.

(iv) If an emergency or unanticipated event interrupts normal Government processes so that proposals cannot be received at the office designated for receipt of proposals by the exact time specified in the solicitation, and urgent Government requirements preclude amendment of the solicitation, the time specified for receipt of proposals will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume.

(v) Proposals may be withdrawn by written notice received at any time before award. Oral proposals in response to oral solicitations may be withdrawn orally. If the solicitation authorizes facsimile proposals, proposals may be withdrawn via facsimile received at any time before award, subject to the conditions specified in the provision at 52.215-5, Facsimile Proposals. Proposals may be withdrawn in person by an offeror or an authorized representative, if the identity of the person requesting withdrawal is established and the person signs a receipt for the proposal before award.

(4) Unless otherwise specified in the solicitation, the offeror may propose to provide any item or combination of items.

(5) Offerors shall submit proposals in response to this solicitation in English, unless otherwise permitted by the solicitation, and in U.S. dollars, unless the provision at FAR 52.225-17, Evaluation of Foreign Currency Offers, is included in the solicitation.

(6) Offerors may submit modifications to their proposals at any time before the solicitation closing date and time, and may submit modifications in response to an amendment, or to correct a mistake at any time before award.

(7) Offerors may submit revised proposals only if requested or allowed by the Contracting Officer.

(8) Proposals may be withdrawn at any time before award. Withdrawals are effective upon receipt of notice by the Contracting Officer.

(d) Offer expiration date. Proposals in response to this solicitation will be valid for the number of days specified on the solicitation cover sheet (unless a different period is proposed by the offeror).

(e) Restriction on disclosure and use of data. Offerors that include in their proposals data that they do not want disclosed to the public for any purpose, or used by the Government except for evaluation purposes, shall--

(1) Mark the title page with the following legend: This proposal includes data that shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed--in whole or in part--for any purpose other than to evaluate this proposal. If, however, a contract is awarded to this offeror as a result of--or in connection with-- the submission of this data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting contract. This restriction does not limit the Government's right to use information contained in this data if it is obtained from another source without restriction. The data subject to this restriction are contained in sheets [insert numbers or other identification of sheets]; and

(2) Mark each sheet of data it wishes to restrict with the following legend: Use or disclosure of data contained on this sheet is subject to the restriction on the title page of this proposal.

(f) Contract award. (1) The Government intends to award a contract or contracts resulting from this solicitation to the responsible offeror(s) whose proposal(s) represents the best value after evaluation in accordance with the factors and subfactors in the solicitation.

- (2) The Government may reject any or all proposals if such action is in the Government's interest.
- (3) The Government may waive informalities and minor irregularities in proposals received.
- (4) The Government intends to evaluate proposals and award a contract without discussions with offerors (except clarifications as described in FAR 15.306(a)). Therefore, the offeror's initial proposal should contain the offeror's best terms from a cost or price and technical standpoint. The Government reserves the right to conduct discussions if the Contracting Officer later determines them to be necessary. If the Contracting Officer determines that the number of proposals that would otherwise be in the competitive range exceeds the number at which an efficient competition can be conducted, the Contracting Officer may limit the number of proposals in the competitive range to the greatest number that will permit an efficient competition among the most highly rated proposals.
- (5) The Government reserves the right to make an award on any item for a quantity less than the quantity offered, at the unit cost or prices offered, unless the offeror specifies otherwise in the proposal.
- (6) The Government reserves the right to make multiple awards if, after considering the additional administrative costs, it is in the Government's best interest to do so.
- (7) Exchanges with offerors after receipt of a proposal do not constitute a rejection or counteroffer by the Government.
- (8) The Government may determine that a proposal is unacceptable if the prices proposed are materially unbalanced between line items or subline items. Unbalanced pricing exists when, despite an acceptable total evaluated price, the price of one or more contract line items is significantly overstated or understated as indicated by the application of cost or price analysis techniques. A proposal may be rejected if the Contracting Officer determines that the lack of balance poses an unacceptable risk to the Government.
- (9) If a cost realism analysis is performed, cost realism may be considered by the source selection authority in evaluating performance or schedule risk.
- (10) A written award or acceptance of proposal mailed or otherwise furnished to the successful offeror within the time specified in the proposal shall result in a binding contract without further action by either party.
- (11) If a post-award debriefing is given to requesting offerors, the Government shall disclose the following information, if applicable:
- (i) The agency's evaluation of the significant weak or deficient factors in the debriefed offeror's offer.
 - (ii) The overall evaluated cost or price and technical rating of the successful and the debriefed offeror and past performance information on the debriefed offeror.
 - (iii) The overall ranking of all offerors, when any ranking was developed by the agency during source selection.
 - (iv) A summary of the rationale for award.
 - (v) For acquisitions of commercial items, the make and model of the item to be delivered by the successful offeror.
 - (vi) Reasonable responses to relevant questions posed by the debriefed offeror as to whether source-selection procedures set forth in the solicitation, applicable regulations, and other applicable authorities were followed by the agency.
- (End of provision)

52.216-1 TYPE OF CONTRACT (APR 1984)

The Government contemplates award of a Firm Fixed Price contract resulting from this solicitation.

(End of clause)

52.217-5 EVALUATION OF OPTIONS (JUL 1990)

Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the option(s).

(End of provision)

52.219-24 SMALL DISADVANTAGED BUSINESS PARTICIPATION PROGRAM--TARGETS (OCT 2000)

(a) This solicitation contains a source selection factor or subfactor related to the participation of small disadvantaged business (SDB) concerns in the contract. Credit under that evaluation factor or subfactor is not available to an SDB concern that qualifies for a price evaluation adjustment under the clause at FAR 52.219-23, Notice of Price Evaluation Adjustment for Small Disadvantaged Business Concerns, unless the SDB concern specifically waives the price evaluation adjustment.

(b) In order to receive credit under the source selection factor or subfactor, the offeror must provide, with its offer, targets, expressed as dollars and percentages of total contract value, for SDB participation in any of the North American Industry Classification System (NAICS Industry Subsectors as determined by the Department of Commerce. The targets may provide for participation by a prime contractor, joint venture partner, teaming arrangement member, or subcontractor; however, the targets for subcontractors must be listed separately.

(End of provision)

52.228-1 BID GUARANTEE (SEP 1996)

(a) Failure to furnish a bid guarantee in the proper form and amount, by the time set for opening of bids, may be cause for rejection of the bid.

(b) The bidder shall furnish a bid guarantee in the form of a firm commitment, e.g., bid bond supported by good and sufficient surety or sureties acceptable to the Government, postal money order, certified check, cashier's check, irrevocable letter of credit, or, under Treasury Department regulations, certain bonds or notes of the United States. The Contracting Officer will return bid guarantees, other than bid bonds, (1) to unsuccessful bidders as soon as practicable after the opening of bids, and (2) to the successful bidder upon execution of contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the bid as accepted.-

(c) The amount of the bid guarantee shall be _____ percent of the bid price or \$_____, whichever is less.-

(d) If the successful bidder, upon acceptance of its bid by the Government within the period specified for acceptance,

fails to execute all contractual documents or furnish executed bond(s) within 10 days after receipt of the forms by the bidder, the Contracting Officer may terminate the contract for default.-

(e) In the event the contract is terminated for default, the bidder is liable for any cost of acquiring the work that exceeds the amount of its bid, and the bid guarantee is available to offset the difference.

(End of clause)

52.232-13 NOTICE OF PROGRESS PAYMENTS (APR 1984)

The need for customary progress payments conforming to the regulations in Subpart 32.5 of the Federal Acquisition Regulation (FAR) will not be considered as a handicap or adverse factor in the award of the contract. The Progress Payments clause included in this solicitation will be included in any resulting contract, modified or altered if necessary in accordance with subsection 52.232-16 and its Alternate I of the FAR. Even though the clause is included in the contract, the clause shall be inoperative during any time the contractor's accounting system and controls are determined by the Government to be inadequate for segregation and accumulation of contract costs.

(End of clause)

52.233-2 SERVICE OF PROTEST (AUG 1996)

(a) Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the General Accounting Office (GAO), shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from **Cheryl Anderson, Chief Contracting Division, CENWS-CT-CB, P.O. Box 3755, Seattle WA 98124-3755.**

(b) The copy of any protest shall be received in the office designated above within one day of filing a protest with the GAO.

(End of provision)

52.236-28 PREPARATION OF PROPOSALS--CONSTRUCTION (OCT 1997)

(a) Proposals must be (1) submitted on the forms furnished by the Government or on copies of those forms, and (2) manually signed. The person signing a proposal must initial each erasure or change appearing on any proposal form.

(b) The proposal form may require offerors to submit proposed prices for one or more items on various bases, including--

(1) Lump sum price;

(2) Alternate prices;

(3) Units of construction; or

(4) Any combination of paragraphs (b)(1) through (b)(3) of this provision.

(c) If the solicitation requires submission of a proposal on all items, failure to do so may result in the proposal being rejected without further consideration. If a proposal on all items is not required, offerors should insert the words "no proposal" in the space provided for any item on which no price is submitted.

(d) Alternate proposals will not be considered unless this solicitation authorizes their submission.

(End of provision)

Basis of Award (52.214-4022)

Notwithstanding any other provision of this invitation, the Government will award all base bid items as a minimum.

52.214-5000 APPARENT CLERICAL MISTAKES (MAR 1995)--EFARS

(a) For the purpose of initial evaluations of bids, the following will be utilized in the resolving arithmetic discrepancies found on the face of bidding schedule as submitted by the bidder:

- (1) Obviously misplaced decimal points will be corrected;
- (2) Discrepancy between unit price and extended price, the unit price will govern;
- (3) Apparent errors in extension of unit prices will be corrected;
- (4) Apparent errors in addition of lump-sum and extended prices will be corrected.

(b) For the purpose of bid evaluation, the government will proceed on the assumption that the bidder intends his bid to be evaluated on basis of the unit prices, the totals arrived at by resolution of arithmetic discrepancies as provided above and the bid will be so reflected on the abstract of bids.

(c) These correction procedures shall not be used to resolve any ambiguity concerning which bid is low.

(End of statement)

INFORMATION REGARDING PERFORMANCE AND PAYMENT BONDS (FAR 28.102) (52.228-4001) FEB 2001

Within 10 days after the prescribed forms are presented to the bidder to whom award is made, unless a shorter time is prescribed in the contract, two bonds, namely a performance bond (Standard Form 25) and a payment bond (Standard Form 25A), shall be executed and furnished to the Government, each with good and sufficient surety or sureties acceptable to the Government. The penal sums of such bonds shall be as follows:

- (1) Performance Bond. The penal sum of the performance bond shall equal one hundred percent (100%) of the contract price.
- (2) Payment Bond. The penal sum of the payment bond shall equal one hundred percent (100%) of the contract price.

Any bonds furnished must be furnished by the Contractor to the Government prior to commencement of contract performance.

INDIVIDUAL SURETIES (52.228-4003) DEC 1999

As prescribed in FAR 28.203, individual sureties are acceptable for all types of bonds except position schedule bonds.

One individual surety is adequate support for a bond, provided the unencumbered value of the assets pledged by that individual surety equal or exceed the amount of the bond. An offeror may submit up to three individual sureties for each bond, in which case the pledged assets, when combined, must equal or exceed the penal amount of the bond. Each individual surety must accept both joint and several liability to the extent of the penal amount of the bond.

An individual surety may be accepted only if a security interest in acceptable assets is provided to the Government by the individual surety. THE SECURITY INTEREST SHALL BE FURNISHED WITH THE BOND.

Acceptable assets include:

- (a) Cash, or certificates of deposit, or other cash equivalents with a federally insured financial institution;
- (b) United States Government securities at market value.
- (c) Stocks and bonds actively traded on a national U.S. security exchange with certificates issued in the name of the individual surety. (See FAR 28.203-2(b)(3) for list of acceptable exchanges).

(d) Real property owned in fee simple by the surety without any form of concurrent ownership, except as provided in FAR 28.203-2(c) (3)(iii), and located within the 50 United States, its territories, or possessions. These assets will be accepted at 100% of the most current tax assessment value (exclusive of encumbrances) or 75% of the properties' unencumbered market value provided a current appraisal is furnished. (See clause entitled "Pledges of Assets").

(e) Irrevocable letters of credit (ILC) issued by a federally insured financial institution in the name of the contracting agency and which identify the agency and solicitation or contract number for which the ILC is provided.

Unacceptable assets include but are not limited to:

- (a) Notes or accounts receivable;
- (b) Foreign securities;
- (c) Real property as follows:
 - (1) Real property located outside the United States, its territories, or possessions.
 - (2) Real property which is a principal residence of the surety.
 - (3) Real property owned concurrently regardless of the form of co-tenancy (including joint tenancy, tenancy by the entirety, and tenancy in common) except where all co-tenants agree to act jointly.
 - (4) Life estates, leasehold estates, or future interests in real property.
- (d) Personal property other than that listed as acceptable assets above (e.g., jewelry, furs, antiques);
- (e) Stocks and bonds of the individual surety in a controlled, affiliated, or closely held concern of the offeror/contractor;
- (f) corporate assets (e.g., plant and equipment);
- (g) Speculative assets (e.g., mineral rights);
- (h) Letters of credit, except as provided above.

In order for the Contracting Officer to determine the acceptability of individuals proposed as sureties, all bidders/offerors who submit bonds which are executed by individual sureties shall furnish with the bonds:

- (a) SF28, Affidavit of Individual Surety,
 - (b) Security interest provided to the Government for all pledged assets (See clause entitled "Pledge of Assets")
- and

(c) A current list of all other bonds (including Bid Bonds) on which each individual surety is a surety and bonds for which the individual is requesting to be a surety, together with a statement as to the percent of completion of these bonded jobs. The list will include Contract or Solicitation Numbers, the name, address and telephone number of the contracting office, the type of bond (bid, performance or payment), and the amount of each original obligation. (Note: Performance and Payment bonds must be listed separately.)

Failure to furnish this information may result in non-approval of the surety and a determination of nonresponsibility.

MAGNITUDE OF CONSTRUCTION (FAR 36.204) (52. 236-4902) DEC 1999

- (a) Amount of Construction for this solicitation is in the range of **\$1,000,000 to \$5,000,000.**

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SECTION 00110 – PROPOSAL SUBMISSION AND EVALUATION

1. **INTRODUCTION:**

1.1 Your firm is invited to submit a proposal in response to Request for Proposals (RFP) No. **W912DW-05-R-0018** entitled **Corrosion Control Aerospace Ground Equipment Facility, Malmstrom AFB, Montana.** This RFP establishes project requirements and provides procedures, format, and other data to assist offerors in preparing their proposals. **It is the intent of the Government to make award based upon initial offers, without further discussions or additional information.** A contract will be awarded to the firm submitting the proposal that conforms to the RFP, is considered to provide the most advantageous offer in terms of the evaluation factors, including price, and is determined to be the best value of the Government.

1.2 This project consists of construction of a new Corrosion Control Aerospace Ground Equipment Facility that includes approximately 13,117 SF (1219 SM) of operational space and 3,153 SF (293SM) of administrative space. The facility requires an adequate ventilation system, increased flammables storage, an adequate electrical system for AGE equipment, a powerful compressor, provision for the "flame-coating" process, garage for maintenance vehicles and lightcart warm storage, and a fire safety code-compliant fire suppression and alarm system. The administrative area requires a locker room complete with showers, offices, a training room, and storage.

2. **EVALUATION FACTORS:**

2.1 Proposals will be evaluated on the basis of two criteria, **TECHNICAL** and **PRICE**. Award will be made to the offeror who proposes the combination of price and technical factors that represent the best value to the government based on the evaluation criteria listed below.

2.2 **TECHNICAL EVALUATION CRITERIA:** The technical criteria, listed in **descending order of importance**, are as follows:

1. Relevant Experience of the Prime
2. Past Performance of the Prime
3. Qualifications of Key Team Members
4. Extent of Small Business Participation

2.3 **RELATIVE IMPORTANCE DEFINITIONS:** For this evaluation, the following terms will be used to establish the relative importance of the technical criteria:

- **More Important:** The criterion is (two) times more important in value to the Government than another criterion.

2.4 **SUMMARY OF ORDER OF IMPORTANCE for Technical Criteria:**

- Criterion 1, 2, and 3 are equal to each other and are each more important than criterion 4.

2.5 EVALUATION STANDARDS. Evaluation criteria will be rated using the following adjectival descriptions.

OUTSTANDING - Information submitted demonstrates offeror's potential to significantly exceed performance or capability standards. The offeror has clearly demonstrated an understanding of all aspects of the requirements to the extent that timely and the highest quality performance are anticipated. Has exceptional strengths that will significantly benefit the Government. The offeror convincingly demonstrated that the RFP requirements have been analyzed, evaluated, and synthesized into approaches, plans, and techniques that, when implemented, should result in outstanding, effective, efficient, and economical performance under the contract. Significantly exceeds most or all solicitation requirements. **VERY HIGH PROBABILITY OF SUCCESS.**

ABOVE AVERAGE - Information submitted demonstrates offeror's potential to exceed performance or capability standards. Has one or more strengths that will benefit the Government. The areas in which the offeror exceeds the requirements are anticipated to result in a high level of efficiency or productivity or quality. The submittal contains excellent features that will likely produce results very beneficial to the Government. Fully meets all RFP requirements and significantly exceeds many of the RFP requirements. Disadvantages are minimal. **HIGH PROBABILITY OF SUCCESS.**

SATISFACTORY (Neutral) - Information submitted demonstrates offeror's potential to meet performance or capability standards. An acceptable solution is provided. Either meets all RFP requirements for the criterion or contains weaknesses in some areas that are offset by strengths in other areas. A rating of "Satisfactory" indicates that, in terms of the specific criterion (or sub-criterion), the offeror has a reasonable probability of success, as there is sufficient confidence that a fully compliant level of performance will be achieved. The proposal demonstrates an adequate understanding of the scope and depth of the RFP requirements. No significant advantages or disadvantages. Equates to neutral. **REASONABLE PROBABILITY OF SUCCESS.**

MARGINAL – The submittal is not adequately responsive or does not address the specific criterion. The offeror's interpretation of the Government's requirements is so superficial, incomplete, vague, incompatible, incomprehensible, or incorrect as to be considered deficient. Proposal does not meet some of the minimum requirements. The assignment of a rating within the bounds of "Marginal" indicates that mandatory corrective action would be required to prevent significant deficiencies from affecting the overall project. The offeror's plans or approach will likely result in questionable quality of performance, which represents a moderate level of risk to the Government. Low probability of success although the submittal has a reasonable chance of becoming at least acceptable. Significant disadvantages. **LOW PROBABILITY OF SUCCESS.**

UNSATISFACTORY – Fails to meet performance or capability standards. Unacceptable. Requirements can only be met with major changes to the submittal. There is no reasonable expectation that acceptable performance would be achieved. The proposal contains many deficiencies and/or gross omissions; fails to provide a reasonable, logical approach to fulfilling much of the Government's requirements; and/or fails to meet most or all of the minimum requirements. Very significant disadvantages. **VERY LOW PROBABILITY OF SUCCESS.**

2.6 DEFINITIONS OF STRENGTH, WEAKNESS AND DEFICIENCY:

Strength: A substantive aspect, attribute, or specific item in the proposal that exceeds the solicitation requirements and enhances the probability of successful contract performance.

Weakness: A flaw in the proposal that increases the risk of unsuccessful contract performance (i.e., meets the RFP requirements, but may have an impact on schedule or quality requirements). A *weakness need not be corrected* for a proposal to be considered for award, but *may* affect the offeror's rating.

Deficiency: A material failure of a proposal to meet the Government requirement or a combination of significant weaknesses in a proposal that increases the risk of contract performance at an unacceptable level. A deficiency *must be corrected* for a proposal to be considered for award.

3. PROPOSAL CONTENTS: Proposals shall be submitted in two parts: (a) Technical proposal and (b) Price proposal. Each part shall be submitted in a separate envelope/package, with the type of proposal (i.e., Technical or Price) clearly printed on the outside of the envelope/package. **For ease of evaluation, submit the proposal following the same organization and title format as specified in paragraph 4.3.6 SUMMARY OF TECHNICAL PROPOSAL FORMAT (for the technical proposal) and paragraph 5.1 SUMMARY OF PRICE PROPOSAL FORMAT (for the price proposal).**

4. TECHNICAL PROPOSAL:

4.1. A **COVER LETTER** should be the **first page** of the technical proposal and should include **(do not put this in the price proposal):**

(a) Solicitation number.

(b) Name, address, and telephone and facsimile numbers of the firm signing the SF 1442 (and electronic address).

(c) Names, titles and telephone and facsimile numbers (and electronic addresses) of persons authorized to negotiate on the firm's behalf with the Government in connection with this solicitation.

(d) Name, title, and signature of the person authorized to sign the proposal.

(e) A statement specifying agreement with all terms, conditions, and provisions included in the solicitation and agreement to furnish any and all items upon which prices are offered at the proposed item prices.

(f) **FINAL PROPOSAL REVISION:** If required to submit a Final Proposal Revision, the accompanying cover letter must identify all changes made to the firm's initial proposal.

4.2 GENERAL TECHNICAL PROPOSAL REQUIREMENTS: Offerors submitting proposals for this project should limit submissions to data essential for evaluation of proposals so that a minimum of time and monies will have been expended in preparing information required herein. Elaborate artwork, expensive paper and bindings, and expensive/extensive visual and other presentation aids are unnecessary. However, in order to be effectively and equitably evaluated, the proposals must include information sufficiently detailed to clearly describe the offeror's experience and management capabilities to successfully complete the project. Any deviations from requirements should be clearly noted and justified in the proposal.

4.3. MINIMUM SUBMITTAL REQUIREMENTS FOR TECHNICAL PROPOSAL:

4.3.1. RELEVANT EXPERIENCE OF THE PRIME.

Submittal Requirements: Provide three (3) projects for the prime construction firm demonstrating relevant experience in the \$1,000,000 to \$5,000,000 range. "Relevant experience" is defined as experience constructing facilities similar to the project in this solicitation in scope, complexity, and dollar value. Only relevant projects currently in progress (at least 75% complete) or completed within the past ten (10) years shall be submitted. Start with the most recent and relevant projects and work backwards in time. The projects selected should clearly demonstrate the construction capabilities of the Offeror in one or more of the areas described in this paragraph.

Use a format similar to that shown in the table below to present this information.

Project Title & Location
Project Type (e.g., design-build (DB), construction (C))
Dollar Value (design \$; construction \$)
Start & Completion Dates (Month/Year)
Role of Firm(s) (e.g., prime) (address type of work performed and percentage of work, as applicable)
Brief Description of Project (address how this relates to solicitation project)
Customer Point of Contact (i.e., name, relationship to project, agency/firm affiliation, city, state, current phone no.)
Awards or recognition received (if applicable)
Firms on the proposed team that performed this project

Evaluation Method: This criterion will be evaluated for the quantity and quality of experience demonstrated. The greater the relevance and the more recent the prior project experience, the higher the rating assigned during evaluations. Demonstration of experience in completing projects that had the unique characteristics of the proposed project will be evaluated favorably.

4.3.2. PAST PERFORMANCE OF THE PRIME

Submittal Requirements: The Government will utilize performance evaluations contained in the Construction Contract Administration Support System (CCASS) to evaluate this criterion. All performance ratings for the past ten (10) years shall be considered. If an offeror does not have past performance available in CCASS or wishes to augment the CCASS system ratings, the offeror may ask customers to submit the Customer Satisfaction Survey form found at the end of this section.

For each project constructed for Private Industry, provide a completed Customer Satisfaction Survey for each applicable project that is currently under construction (at least 75% complete) or that was completed within the last ten (10) years. No more than five (5) customer satisfaction surveys will be considered for the prime firm for work not listed in the CCASS system. All Customer Satisfaction Surveys must be submitted to the Government from the customer or agency that is providing the information. Further instructions are found on the Customer Satisfaction Survey.

Submit a list of all customers (including current Point of Contact, phone number, and electronic address) who were requested to provide Customer Satisfaction Surveys.

Should offerors want to review the performance evaluation ratings contained in the Corps of Engineers CCASS Database, they may request the information by fax on company letterhead at the following number: (503) 808-4596.

Evaluation Method. The Government will evaluate the relative merits of each offeror's past performance. The Government reserves the right to consider all aspects of an offeror's performance history but will first evaluate the performance of those projects listed in 4.3.1. Projects involving the unique characteristics of the proposed project may be given more consideration. The Government reserves the right to contact the evaluators on previous Government or Private Sector work to verify the offeror's construction experience. In the case of an offeror without a record of past performance or for whom information on past performance is not available, the offeror **may not be evaluated as favorable or unfavorable** on past performance (See FAR 15.305(a)(2)(iv)).

4.3.3. QUALIFICATIONS OF KEY TEAM MEMBERS

Submittal Requirements: The Offeror shall submit the names and résumés for key construction personnel that will be assigned to this project. In addition, the Offeror shall provide a concise summary of the duties and responsibilities for each of the proposed individuals which clearly indicates separate duties and responsibilities for each of the following positions; Project

Superintendent, Project Manager, and Contractor Quality Control System Manager. The proposal must clearly present the separate credentials for each position of each person performing the duties of the position to which they are identified. Resumes must include a maximum of three (3) examples of project experience, and educational qualifications, if applicable. For project experience, provide the same information as described in 4.3.3 below. It is expected that the proposed key team members will be the individuals who perform work under the contract. **The contracting officer must approve substitute personnel.** Resumes should be no more than two (2) pages per individual and submitted in a format similar to the one below. As a minimum, the contractor shall include data on the following personnel:

4.3.3.1. Project Superintendent: The Project Superintendent shall have no less than 5 years experience as a project superintendent on construction projects of similar scope, size and complexity. The experience must demonstrate construction knowledge and ability to manage technically complex mechanical projects and be consistent with the type of construction provided for in this solicitation.

4.3.3.2. Project Manager: The Project Manager shall have a baccalaureate degree in a relevant field such as engineering or construction management with a minimum of three (3) projects that demonstrates the ability to construct projects similar in scope, cost and complexity to this contract **or** a person in the construction field with a minimum of 5 years in as a project manager on projects of the same scope, size and complexity of this contract.

4.3.3.3. CQC System Manager: The CQC (Contractor Quality Control) System Manager shall be a mechanical engineer with a minimum of five (5) years experience in related work or a mechanical engineering technician with ten (10) years of experience and five (5) years of experience in work related to this project. This experience must have occurred within the past ten (10) years.

4.3.3.4. Resume Format For Key Team Members. Resumes should be no more than two (2) pages per individual and submitted in a format similar to the one below:

RESUME FORMAT

Name and Title

- 1. Proposed Duties/Functions for this project***
- 2. Firm Affiliation and Years Affiliated***
- 3. Years of Experience performing duties/functions as proposed for this project.***
- 4. Education – School attended, Degree, Certification, Year, and Specialization***
- 5. List Active Registrations (Professional or Technical Licenses/Certifications)***
- 6. Describe Specific Qualifications for this project***
- 7. List Projects worked on to Include:***
 - Project Title & Location***
 - Scope, Size and Complexity***
 - Duties/Functions***
 - Date of project***

8. Demonstrate how each project submitted is relevant to the project to be constructed under this solicitation

Evaluation Method: The more recent, and the greater the extent and relevance, of the team members' qualifications, prior project experience, and active registrations, the higher the rating assigned for this criterion during evaluations. Only one individual for each of the key personnel categories listed above will be evaluated.

4.3.4. EXTENT OF SMALL BUSINESS PARTICIPATION

Submittal Requirements: No submittal is required for this criterion. The Government will utilize performance evaluations contained in CCASS to evaluate this criterion.

Evaluation Method: Firms will be evaluated for the success and extent of their small business participation in their subcontracting with small and disadvantaged business concerns. Firms will be evaluated based on the ratings received for item entitled "Implementation of Subcontracting Plan" on their past performance evaluations retrieved from the CCAS System. Firms without any evaluations in CCASS, or for which this item was not evaluated (i.e., N/A), will be assigned a neutral rating of satisfactory. Firms that receive a rating below satisfactory for this item in one or more CCASS evaluations will receive a rating of marginal for this criterion.

4.3.5. SUMMARY OF TECHNICAL PROPOSAL FORMAT: As a minimum, each copy of the technical proposal should contain the following general format for the volumes specified in the table below. It is preferred that pages be numbered consecutively throughout the technical proposal. However, giving each page a unique identifier within sections is acceptable (i.e., A-1 through A-5, then B-1 through B-5, etc).

Technical Proposal Format (original and 5 copies required)

- Technical Proposal Cover Letter
- Table of Contents. (List all sections of the technical proposal)
- Relevant Experience of the Prime
- Qualifications of Key Team Members
- Past Performance of the Prime

5. PRICE PROPOSAL

5.1 SUMMARY OF PRICE PROPOSAL FORMAT:

Price Proposal Format (original and (1) copy required)

- Standard Form 1442 front and back
- Corporate Certificate (use the certificate for joint venture if applicable)
- Pricing Schedule (all pages)
- Section 00600, Representations and Certifications
- Bank and Bonding Points of Contact
- 20% Bid Bond
- Small and Small Disadvantaged Business Subcontracting Plan (large businesses only)

- Joint Venture Information (if applicable)

NOTE: Price proposal and bonds are DUE AT SAME TIME as technical proposals.

5.2. The price proposal must be signed by an official authorized to bind the organization. Prices must be provided for all line items on the pricing schedule. Note that the Standard Form 1442, Block 13D, states the minimum number of calendar days after the date offers are due for Government acceptance of the offer. All amendments must be acknowledged on Standard Form 1442 BACK by date and number in Block 19 or by telegram.

5.3. Provide the name, point of contact, phone number, and address for bank and bonding company of firm signing the SF 1442.

5.4. **Bid Bonds** must be accompanied by a **Power of Attorney containing an original signature from the surety**, which must be affixed to the Power of Attorney after the Power of Attorney has been generated. Computer generated and signed Powers of Attorney will only be accepted if accompanied by an original certification from a current officer of the surety attesting to its authenticity and continuing validity. Performance and payment bonds have the same requirement.

5.5. **Small Business Subcontracting. Large businesses are required to submit a subcontracting plan** (See FAR Clause 52.219-9 Alt II, Small Business Subcontracting Plan, Jan 2002) with initial price proposals. Award will not be made under this solicitation without an approved subcontracting plan. See the "Notice to Large Business Firms" located in the front of this solicitation.

5.6. **Joint Ventures.** No contract may be awarded to a joint venture that is not registered in the Central Contractor Register (CCR). Joint ventures may register in the following way:

(a) The firm that will be the recipient of payments should be registered in the CCR and have a DUNS number. This firm is considered in the CCR to be the "mother firm." If no money is to go to any other firm in the joint venture, the mother firm may make the other firm in the joint venture a "child." This child will be assigned the mother firm's CCR number with an additional four (4) numbers attached. Since the child firm is not receiving any payments, they do not need to get a DUNS number. HOWEVER, in order to cover all possibilities, it might be advisable to have each firm registered in the CCR.

(b) Call the CCR at 1-888-227-2423, choose option "0" to get the mother-child relationship set up. DUN & Bradstreet phone number is 1-800-333-0505.

(c) If the joint venture has a newly created name, then it must have its own DUNS number and register as such in the CCR.

5.6.1. In the cover letter of your proposal, provide the complete names, addresses, and phone and fax numbers of the two firms in the joint venture.

5.6.2. Signature requirements: SF 1442, SOLICITATION, OFFER, AND AWARD (pages 00010-1 and 00010-2), Block 20 requires that the name and title of the person authorized to sign the offer for the joint venture be provided.

5.6.3. Corporate certificate: Ensure that joint-venture portion is completed by both firms.

5.6.4. In the case of a joint venture, the following is required: A contract with joint venturers may involve any combination of individuals, partnerships, or corporations. The contract shall be signed by each participant in the joint venture in the manner prescribed below for each type of participant. When a corporation is participating, the Contracting Officer shall verify that the corporation is authorized to participate in the joint venture.

(a) Individuals. A contract with an individual shall be signed by that individual. A contract with an individual doing business as a firm shall be signed by that individual, and the signature shall be followed by the individual's types, stamped, or printed name and the words "an individual doing business as" [insert name of firm].

(b) Partnerships. A contract with a partnership shall be signed in the partnership name. Before signing for the Government, the Contracting Officer shall obtain a list of all partners and ensure that the individual(s) signing for the partnership have authority to bind the partnership.

(c) Corporations. A contract with a corporation shall be signed in the corporate name, followed by the word "by" and the signature and title of the person authorized to sign. The Contracting Officer shall ensure that the person signing for the corporation has authority to bind the corporation.

5.6.5. In addition to the requirements stated above, and to assure a single point of contact for resolution of contractual matters and payments, the Contracting Officer shall obtain a certificate signed by each participant in the joint venture as follows: In the proposal include the following statement:

"The parties hereto expressly understand and agree as follows:

a. **(name, title, and company)** is the principal representative of the joint venture. As such, all communications regarding the administration of the contract and the performance of the work thereunder may be directed to him or her. In the absence of **(same name, title, and company)**, **(enter name, title, and company of alternate)** is the alternate principal representative of the joint venture.

b. Direction, approvals, required notices, and all other communications from the Government to the joint venture, including transmittal of payments by the Government, shall be directed to **(enter name, title, and company of principal)**, principal representative of the joint venture."

5.6.6. The bid bond form, Block "Principal" requires that the name and title of the person authorized to sign for the joint venture be included.

5.6.7. After award, the performance and payment bonds, and the insurance certificate(s) provided shall be in the name of the joint venture.

6. MAGNITUDE OF CONSTRUCTION AND SERVICES: The dollar magnitude of the construction portion of this solicitation is between *\$1 million and \$5 million.*

7. EVALUATION PROCEDURES

7.1 TECHNICAL EVALUATION: Technical proposals will be evaluated by a Technical Evaluation Team (TET) comprised of representatives of the Corps of Engineers and the Using Agency. Pricing data will not be considered during this evaluation. Criteria for the technical evaluation are set forth elsewhere in the solicitation and will be the sole basis for determining the technical merit of proposals. The TET shall utilize the relative importance definitions and technical merit ratings described earlier in this section of the solicitation to perform their technical evaluation. To be considered for award, proposals must conform to the terms and conditions contained in the RFP. No proposal will be accepted that does not address all criteria specified in this solicitation or which includes stipulations or qualifying conditions unacceptable to the Government.

7.2 PRICE EVALUATION: Pricing will be independently evaluated to determine reasonableness and to aid in the determination of the firm's understanding of the work and ability to perform the contract. Financial capacity and bonding ability will be verified.

8. SELECTION AND AWARD: Subject to provisions contained herein, award of a firm fixed-price contract shall be made to a single firm. The Government will select the best-value offer based on technical merit and price.

8.1. BEST VALUE ANALYSIS. The Government is more concerned with obtaining superior technical features than with making award at the lowest overall cost to the Government. In determining the best value to the Government, the tradeoff process of evaluation will be utilized. The tradeoff process permits tradeoffs among price and technical factors, and allows the Government to consider award to other than the lowest priced offeror or other than the highest technically rated offeror. You are advised that greater consideration will be given to the evaluation of technical proposals rather than price. It is pointed out, however, that should technical competence between offerors be considered approximately the same, the cost or price could become more important in determining award.

8.2. SELECTION AND AWARD WITHOUT DISCUSSIONS: **It is the intent of the Government to make award based upon initial offers, without further discussions or additional information** Therefore, initial proposals should be submitted based on the most favorable terms from a price and technical standpoint. Do not assume there will be an opportunity to clarify, discuss or revise proposals. If award is not made on initial offers, a competitive range will be established and discussions conducted as described below.

8.3. COMPETITIVE RANGE: If it is not in the Government's best interest to make award on initial offers, the Contracting Officer will establish a competitive range of one or more offers and

conduct discussions with those firms. When determining the competitive range, the Contracting Officer will consider the technical ratings and prices offered.

8.4. **DISCUSSIONS:** Discussions are usually conducted in writing, but may also be by telephone or in person. Discussions are tailored to each offeror's proposal and are only conducted with offeror(s) in the competitive range. The primary objective of discussions is to maximize the Government's ability to obtain the best value, based on the requirement and the evaluation criteria set forth in this solicitation. If a firm's proposal is eliminated or otherwise removed from consideration for award during discussions, no further revisions to that firm's proposal will be accepted or considered. Discussions will culminate in a request for Final Proposal Revision the date and time of which will be common to all remaining firms.

8.5. **AFTER DISCUSSIONS:** Revisions to the proposals submitted during discussions, if any, will be evaluated by the TET and, if warranted, an adjustment made to the rating previously assigned. The Contracting Officer will then perform a best value analysis based on the final prices and technical proposals. Selection will be made on the basis of the responsive, responsible firm whose proposal conforms to the RFP and represents the most advantageous offer to the Government, subject to availability of funds.

8.6. **DEBRIEFINGS:** Upon written request, unsuccessful firms will be debriefed and furnished the basis for the selection decision and contract award in accordance with FAR 15.505 and FAR 15.506.

8.7. **PROPOSAL EXPENSES AND PRECONTRACT COSTS:** This solicitation does not commit the Government to pay costs incurred in preparation and submission of initial and subsequent proposals or for other costs incurred prior to award of a formal contract.

8.8. **RELEASE OF INFORMATION:** After receipt of proposals and until contract award, source selection information will not be furnished to any firm.

END OF SECTION 00110

CUSTOMER SATISFACTION SURVEY (PAGE 1 OF 2) -**W912DW-05-R-0018, Corrosion Control Aerospace Ground Equipment Facility, Malmstrom AFB,
Montana****SECTION 1 -- TO BE COMPLETED BY OFFEROR AND PROVIDED TO REFERENCE****Name of Firm Being Evaluated:** _____**Project Title & Location:** _____**Project Dollar Value:** _____**Year Completed:** _____ **Project Manager:** _____**SECTION 2 -- TO BE COMPLETED BY THE CUSTOMER REFERENCE AND MAILED,
EMAILED, FAXED OR HAND-DELIVERED DIRECTLY TO:****U.S. Army Corps of Engineers, Seattle District
Attn: CENWS-CT-CB-CU Attn: Sherrye Schmahl
P.O. Box 3755
Seattle, WA 98124-3755****FAX: (206) 764-6817
Street Address:
4735 E. Marginal Way S.
Seattle WA 98134-2329****Forms submitted by other than the customer (i.e., by the offeror), may not be considered.**

OVERVIEW: The firm shown above has selected you as a customer reference to provide information on the firm's past performance. Your input is important to this firm and responses are required no later than the time and date proposals are due for inclusion in our evaluation.

Name of Individual completing survey: _____**Firm Name:** _____ **Phone Number:** _____**Relationship to this Project:** _____

The chart below depicts ratings to be used to evaluate this contractor's performance.

O	AA	S	M	U
Outstanding	Above Average	Satisfactory	Marginal	Unsatisfactory
Performance met all contract requirements and exceeded expectations. Problems, if any, were negligible, and were resolved in a timely and highly effective manner.	Performance met all contract requirements and exceeded some. There were a few minor problems which the contractor resolved in a timely, effective manner.	Performance met contract requirements. There were some minor problems, and corrective actions taken by the contractor were satisfactory.	Performance did not meet some contractual requirements. There were problems, some of a serious nature, for which corrective action was only marginally effective.	Performance did not meet contractual requirements. There were serious problems, and the contractor's corrective actions were ineffective.

CUSTOMER SATISFACTION SURVEY (PAGE 2 OF 2)

W912DW-05-R-0018, Corrosion Control Aerospace Ground Equipment Facility, Malmstrom AFB, Montana

In the following blocks, please indicate your overall level of satisfaction with the work performed by the firm shown in Section 1. Reference the chart outlined on page 1 of this survey.

For any marginal or unsatisfactory rating, please provide explanatory narratives in the remarks block. These narratives need not be lengthy; just detailed. If a question is not applicable, circle N/A. If more space is needed, then go to the end of the questionnaire or attach additional pages. Be sure to identify your continued narration with the respect line number, your name and project name.

	Quality of Work	Circle the appropriate rating using the chart on page 1
A	Quality of Service	O AA S M U N/A
B	Quality Control	O AA S M U N/A
C.	Adequacy of Submittals/Reporting	O AA S M U N/A
D.	Identification/correction of deficient work in a timely manner	O AA S M U N/A
E.	Displayed flexibility in responding to your needs	O AA S M U N/A
F.	Organizational structure/functional relationships of the team including subcontractors	O AA S M U N/A
G.	Response time to your requirements	O AA S M U N/A
H.	Extent of participation of small business concerns as subcontractors under this contract	O AA S M U N/A
I.	Overall rating for this project	O AA S M U N/A
J	How well did the contractor & subcontractors adhere to schedule?	O AA S M U N/A
K.	Would you select this contractor again for future projects?	Yes or No (circle one)

REMARKS: (Discuss strengths and weaknesses of the firm)

Thank you for completing this form. Your assistance in providing this information is appreciated.

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CUSTOMER SATISFACTION SURVEY (PAGE 1 OF 2) -**W912DW-05-R-0018, Corrosion Control Aerospace Ground Equipment Facility, Malmstrom AFB,
Montana****SECTION 1 -- TO BE COMPLETED BY OFFEROR AND PROVIDED TO REFERENCE****Name of Firm Being Evaluated:** _____**Project Title & Location:** _____**Project Dollar Value:** _____**Year Completed:** _____ **Project Manager:** _____**SECTION 2 -- TO BE COMPLETED BY THE CUSTOMER REFERENCE AND MAILED,
EMAILED, FAXED OR HAND-DELIVERED DIRECTLY TO:****U.S. Army Corps of Engineers, Seattle District
Attn: CENWS-CT-CB-CU Attn: Sherrye Schmahl
P.O. Box 3755
Seattle, WA 98124-3755****FAX: (206) 764-6817
Street Address:
4735 E. Marginal Way S.
Seattle WA 98134-2329****Forms submitted by other than the customer (i.e., by the offeror), may not be considered.**

OVERVIEW: The firm shown above has selected you as a customer reference to provide information on the firm's past performance. Your input is important to this firm and responses are required no later than the time and date proposals are due for inclusion in our evaluation.

Name of Individual completing survey: _____**Firm Name:** _____ **Phone Number:** _____**Relationship to this Project:** _____

The chart below depicts ratings to be used to evaluate this contractor's performance.

O	AA	S	M	U
Outstanding	Above Average	Satisfactory	Marginal	Unsatisfactory
Performance met all contract requirements and exceeded expectations. Problems, if any, were negligible, and were resolved in a timely and highly effective manner.	Performance met all contract requirements and exceeded some. There were a few minor problems which the contractor resolved in a timely, effective manner.	Performance met contract requirements. There were some minor problems, and corrective actions taken by the contractor were satisfactory.	Performance did not meet some contractual requirements. There were problems, some of a serious nature, for which corrective action was only marginally effective.	Performance did not meet contractual requirements. There were serious problems, and the contractor's corrective actions were ineffective.

CUSTOMER SATISFACTION SURVEY (PAGE 2 OF 2) W912DW-05-R-0018, Corrosion Control Aerospace Ground Equipment Facility, Malmstrom AFB, Montana		
<p>In the following blocks, please indicate your overall level of satisfaction with the work performed by the firm shown in Section 1. Reference the chart outlined on page 1 of this survey.</p> <p>For any marginal or unsatisfactory rating, please provide explanatory narratives in the remarks block. These narratives need not be lengthy; just detailed. If a question is not applicable, circle N/A. If more space is needed, then go to the end of the questionnaire or attach additional pages. Be sure to identify your continued narration with the respect line number, your name and project name.</p>		
	Quality of Work	Circle the appropriate rating using the chart on page 1
A	Quality of Service	O AA S M U N/A
B	Quality Control	O AA S M U N/A
C.	Adequacy of Submittals/Reporting	O AA S M U N/A
D.	Identification/correction of deficient work in a timely manner	O AA S M U N/A
E.	Displayed flexibility in responding to your needs	O AA S M U N/A
F.	Organizational structure/functional relationships of the team including subcontractors	O AA S M U N/A
G.	Response time to your requirements	O AA S M U N/A
H.	Extent of participation of small business concerns as subcontractors under this contract	O AA S M U N/A
I.	Overall rating for this project	O AA S M U N/A
J	How well did the contractor & subcontractors adhere to schedule?	O AA S M U N/A
K.	Would you select this contractor again for future projects?	Yes or No (circle one)

REMARKS: (Discuss strengths and weaknesses of the firm)

Thank you for completing this form. Your assistance in providing this information is appreciated.

Section 00600 - Representations & Certifications

52.203-2	Certificate Of Independent Price Determination	APR 1985
52.203-11	Certification And Disclosure Regarding Payments To Influence Certain Federal Transactions	APR 1991
52.204-3	Taxpayer Identification	OCT 1998
52.204-5	Women-Owned Business (Other Than Small Business)	MAY 1999
52.209-5	Certification Regarding Debarment, Suspension, Proposed Debarment, And Other Responsibility Matters	DEC 2001
52.215-6	Place of Performance	OCT 1997
52.219-1 Alt I	Small Business Program Representations (May 2004) Alternate I	APR 2002
52.219-19	Small Business Concerns Representation For The Small Business Competitiveness Demonstration Program	OCT 2000
52.219-21	Small Business Size Representation For Targeted Industry Categories Under The Small Business Competitiveness Demonstration Program	MAY 1999
52.219-22	Small Disadvantaged Business Status	OCT 1999
52.222-22	Previous Contracts And Compliance Reports	FEB 1999
52.222-38	Compliance With Veterans' Employment Reporting Requirements	DEC 2001
52.223-4	Recovered Material Certification	OCT 1997
52.223-13	Certification of Toxic Chemical Release Reporting	AUG 2003
252.209-7001	Disclosure of Ownership or Control by the Government of a Terrorist Country	SEP 2004
252.209-7002	Disclosure Of Ownership Or Control By A Foreign Government	SEP 1994
252.247-7022	Representation Of Extent Of Transportation Of Supplies By Sea	AUG 1992

CLAUSES INCORPORATED BY REFERENCE

52.203-2	Certificate Of Independent Price Determination	APR 1985
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CLAUSES INCORPORATED BY FULL TEXT

52.203-11 CERTIFICATION AND DISCLOSURE REGARDING PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (APR 1991)

(a) The definitions and prohibitions contained in the clause, at FAR 52.203-12, Limitation on Payments to Influence Certain Federal Transactions, included in this solicitation, are hereby incorporated by reference in paragraph (b) of this Certification.

(b) The offeror, by signing its offer, hereby certifies to the best of his or her knowledge and belief that on or after December 23, 1989,--

(1) No Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan, or cooperative agreement;

(2) If any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress or an employee of a Member of Congress on his or her behalf in connection with this solicitation, the offeror shall complete and submit, with its offer, OMB standard form LLL, Disclosure of Lobbying Activities, to the Contracting Officer; and

(3) He or she will include the language of this certification in all subcontract awards at any tier and require that all recipients of subcontract awards in excess of \$100,000 shall certify and disclose accordingly.

(c) Submission of this certification and disclosure is a prerequisite for making or entering into this contract imposed by section 1352, title 31, United States Code. Any person who makes an expenditure prohibited under this provision, shall be subject to a civil penalty of not less than \$10,000, and not more than \$100,000, for each such failure.

(End of provision)

52.204-3 TAXPAYER IDENTIFICATION (OCT 1998)

(a) Definitions.

“Common parent,” as used in this provision, means that corporate entity that owns or controls an affiliated group of corporations that files its Federal income tax returns on a consolidated basis, and of which the offeror is a member.

“Taxpayer Identification Number (TIN),” as used in this provision, means the number required by the Internal Revenue Service (IRS) to be used by the offeror in reporting income tax and other returns. The TIN may be either a Social Security Number or an Employer Identification Number.

(b) All offerors must submit the information required in paragraphs (d) through (f) of this provision to comply with debt collection requirements of 31 U.S.C. 7701(c) and 3325(d), reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M, and implementing regulations issued by the IRS. If the resulting contract is subject to the payment reporting requirements described in Federal Acquisition Regulation (FAR) 4.904, the failure or refusal by the offeror to furnish the information may result in a 31 percent reduction of payments otherwise due under the contract.

(c) The TIN may be used by the Government to collect and report on any delinquent amounts arising out of the offeror's relationship with the Government (31 U.S.C. 7701(c)(3)). If the resulting contract is subject to the payment reporting requirements described in FAR 4.904, the TIN provided hereunder may be matched with IRS records to verify the accuracy of the offeror's TIN.

(d) Taxpayer Identification Number (TIN).

___ TIN: _____

___ TIN has been applied for.

___ TIN is not required because:

___ Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the United States and does not have an office or place of business or a fiscal paying agent in the United States;

___ Offeror is an agency or instrumentality of a foreign government;

___ Offeror is an agency or instrumentality of the Federal Government.

(e) Type of organization.

___ Sole proprietorship;

___ Partnership;

___ Corporate entity (not tax-exempt);

___ Corporate entity (tax-exempt);

___ Government entity (Federal, State, or local);

___ Foreign government;

___ International organization per 26 CFR 1.6049-4;

___ Other _____

(f) Common parent.

___ Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this provision.

___ Name and TIN of common parent:

Name _____

TIN _____

(End of provision)

52.204-5 WOMEN-OWNED BUSINESS (OTHER THAN SMALL BUSINESS) (MAY 1999)

(a) Definition. Women-owned business concern, as used in this provision, means a concern that is at least 51 percent owned by one or more women; or in the case of any publicly owned business, at least 51 percent of its stock is owned by one or more women; and whose management and daily business operations are controlled by one or more women.

(b) Representation. [Complete only if the offeror is a women-owned business concern and has not represented itself as a small business concern in paragraph (b)(1) of FAR 52.219-1, Small Business Program Representations, of this solicitation.] The offeror represents that it () is a women-owned business concern.

(End of provision)

52.209-5 CERTIFICATION REGARDING DEBARMENT, SUSPENSION, PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY MATTERS (DEC 2001)

(a)(1) The Offeror certifies, to the best of its knowledge and belief, that-

(i) The Offeror and/or any of its Principals -

(A) Are () are not () presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency;

(B) Have () have not (), within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(C) Are () are not () presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in paragraph (a)(1)(i)(B) of this provision.

(ii) The Offeror has () has not (), within a three-year period preceding this offer, had one or more contracts terminated for default by any Federal agency.

(2) "Principals," for the purposes of this certification, means officers; directors; owners; partners; and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a subsidiary, division, or business segment, and similar positions).

This Certification Concerns a Matter Within the Jurisdiction of an Agency of the United States and the Making of a False, Fictitious, or Fraudulent Certification May Render the Maker Subject to Prosecution Under Section 1001, Title 18, United States Code.

(b) The Offeror shall provide immediate written notice to the Contracting Officer if, at any time prior to contract award, the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(c) A certification that any of the items in paragraph (a) of this provision exists will not necessarily result in withholding of an award under this solicitation. However, the certification will be considered in connection with a determination of the Offeror's responsibility. Failure of the Offeror to furnish a certification or provide such additional information as requested by the Contracting Officer may render the Offeror nonresponsible.

(d) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(e) The certification in paragraph (a) of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Offeror knowingly rendered an erroneous certification, in addition to other remedies available to the Government, the Contracting Officer may terminate the contract resulting from this solicitation for default.

(End of provision)

52.215-6 PLACE OF PERFORMANCE (OCT 1997)

(a) The offeror or respondent, in the performance of any contract resulting from this solicitation, () intends, () does not intend (check applicable block) to use one or more plants or facilities located at a different address from the address of the offeror or respondent as indicated in this proposal or response to request for information.

(b) If the offeror or respondent checks “intends” in paragraph (a) of this provision, it shall insert in the following spaces the required information:

Place of Performance(Street Address, City, State, County, Zip Code)	Name and Address of Owner and Operator of the Plant or Facility if Other Than Offeror or Respondent

(End of provision)

52.219-1 SMALL BUSINESS PROGRAM REPRESENTATIONS (MAY 2004) - ALTERNATE I (APR 2002)

(a)(1) The North American Industry Classification System (NAICS) code for this acquisition is **236210**.

(2) The small business size standard is **\$28.5M**.

(3) The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

(b) Representations. (1) The offeror represents as part of its offer that it () is, () is not a small business concern.

(2) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents, for general statistical purposes, that it () is, () is not a small disadvantaged business concern as defined in 13 CFR 124.1002.

(3) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it () is, () is not a women-owned small business concern.

(4) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it () is, () is not a veteran-owned small business concern.

(5) (Complete only if the offeror represented itself as a veteran-owned small business concern in paragraph (b)(4) of this provision.) The offeror represents as part of its offer that it () is, () is not a service-disabled veteran-owned small business concern.

(6) [Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.] The offeror represents, as part of its offer, that--

(i) It () is, () is not a HUBZone small business concern listed, on the date of this representation, on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration, and no material

change in ownership and control, principal office, or HUBZone employee percentage has occurred since it was certified by the Small Business Administration in accordance with 13 CFR part 126; and

(ii) It () is, () is not a joint venture that complies with the requirements of 13 CFR part 126, and the representation in paragraph (b)(6)(i) of this provision is accurate for the HUBZone small business concern or concerns that are participating in the joint venture. (The offeror shall enter the name or names of the HUBZone small business concern or concerns that are participating in the joint venture:_____.) Each HUBZone small business concern participating in the joint venture shall submit a separate signed copy of the HUBZone representation.

(7) (Complete if offeror represented itself as disadvantaged in paragraph (b)(2) of this provision.) The offeror shall check the category in which its ownership falls:

_____ Black American.

_____ Hispanic American.

_____ Native American (American Indians, Eskimos, Aleuts, or Native Hawaiians).

_____ Asian-Pacific American (persons with origins from Burma, Thailand, Malaysia, Indonesia, Singapore, Brunei, Japan, China, Taiwan, Laos, Cambodia (Kampuchea), Vietnam, Korea, The Philippines, U.S. Trust Territory of the Pacific Islands (Republic of Palau), Republic of the Marshall Islands, Federated States of Micronesia, the Commonwealth of the Northern Mariana Islands, Guam, Samoa, Macao, Hong Kong, Fiji, Tonga, Kiribati, Tuvalu, or Nauru).

_____ Subcontinent Asian (Asian-Indian) American (persons with origins from India, Pakistan, Bangladesh, Sri Lanka, Bhutan, the Maldives Islands, or Nepal).

_____ Individual/concern, other than one of the preceding.

(c) Definitions. As used in this provision--

Service-disabled veteran-owned small business concern--

(1) Means a small business concern--

(i) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and

(ii) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a service-disabled veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.

(2) Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service-connected, as defined in 38 U.S.C. 101(16).

"Small business concern," means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR Part 121 and the size standard in paragraph (a) of this provision.

Veteran-owned small business concern means a small business concern--

(1) Not less than 51 percent of which is owned by one or more veterans (as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and

(2) The management and daily business operations of which are controlled by one or more veterans.

"Women-owned small business concern," means a small business concern --

(1) That is at least 51 percent owned by one or more women or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; or

(2) Whose management and daily business operations are controlled by one or more women.

(d) Notice.

(1) If this solicitation is for supplies and has been set aside, in whole or in part, for small business concerns, then the clause in this solicitation providing notice of the set-aside contains restrictions on the source of the end items to be furnished.

(2) Under 15 U.S.C. 645(d), any person who misrepresents a firm's status as a small, HUBZone small, small disadvantaged, or women-owned small business concern in order to obtain a contract to be awarded under the preference programs established pursuant to section 8(a), 8(d), 9, or 15 of the Small Business Act or any other provision of Federal law that specifically references section 8(d) for a definition of program eligibility, shall--

(i) Be punished by imposition of fine, imprisonment, or both;

(ii) Be subject to administrative remedies, including suspension and debarment; and

(iii) Be ineligible for participation in programs conducted under the authority of the Act.

(End of provision)

52.219-19 SMALL BUSINESS CONCERN REPRESENTATION FOR THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM (OCT 2000)

(a) Definition.

"Emerging small business" as used in this solicitation, means a small business concern whose size is no greater than 50 percent of the numerical size standard applicable to the North American Industry Classification System (NAICS) code assigned to a contracting opportunity.

(b) [Complete only if the Offeror has represented itself under the provision at 52.219-1 as a small business concern under the size standards of this solicitation.] The Offeror [] is, [] is not an emerging small business.

(c) (Complete only if the Offeror is a small business or an emerging small business, indicating its size range.)

Offeror's number of employees for the past 12 months (check this column if size standard stated in solicitation is expressed in terms of number of employees) or Offeror's average annual gross revenue for the last 3 fiscal years (check this column if size standard stated in solicitation is expressed in terms of annual receipts). (Check one of the following.)

No. of Employees Avg. Annual Gross Revenues

☐ 50 or fewer ☐ \$1 million or less
☐ 51 - 100 ☐ \$1,000,001 - \$2 million
☐ 101 - 250 ☐ \$2,000,001 - \$3.5 million
☐ 251 - 500 ☐ \$3,500,001 - \$5 million
☐ 501 - 750 ☐ \$5,000,001 - \$10 million
☐ 751 - 1,000 ☐ \$10,000,001 - \$17 million
☐ Over 1,000 ☐ Over \$17 million

(End of provision)

52.219-21 SMALL BUSINESS SIZE REPRESENTATION FOR TARGETED INDUSTRY CATEGORIES UNDER THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM (MAY 1999)

(Complete only if the Offeror has represented itself under the provision at 52.219-1 as a small business concern under the size standards of this solicitation.)

Offeror's number of employees for the past 12 months (check this column if size standard stated in solicitation is expressed in terms of number of employees) or Offeror's average annual gross revenue for the last 3 fiscal years (check this column if size standard stated in solicitation is expressed in terms of annual receipts). (Check one of the following.)

No. of Employees Avg. Annual Gross Revenues

☐ 50 or fewer ☐ \$1 million or less
☐ 51 - 100 ☐ \$1,000,001 - \$2 million
☐ 101 - 250 ☐ \$2,000,001 - \$3.5 million
☐ 251 - 500 ☐ \$3,500,001 - \$5 million
☐ 501 - 750 ☐ \$5,000,001 - \$10 million
☐ 751 - 1,000 ☐ \$10,000,001 - \$17 million
☐ Over 1,000 ☐ Over \$17 million

(End of provision)

52.219-22 SMALL DISADVANTAGED BUSINESS STATUS (OCT 1999)

(a) General. This provision is used to assess an offeror's small disadvantaged business status for the purpose of obtaining a benefit on this solicitation. Status as a small business and status as a small disadvantaged business for general statistical purposes is covered by the provision at FAR 52.219-1, Small Business Program Representation.

(b) Representations.

(1) General. The offeror represents, as part of its offer, that it is a small business under the size standard applicable to this acquisition; and either--

___ (i) It has received certification by the Small Business Administration as a small disadvantaged business concern consistent with 13 CFR 124, Subpart B; and

(A) No material change in disadvantaged ownership and control has occurred since its certification;

(B) Where the concern is owned by one or more disadvantaged individuals, the net worth of each individual upon whom the certification is based does not exceed \$750,000 after taking into account the applicable exclusions set forth at 13 CFR 124.104(c)(2); and

(C) It is identified, on the date of this representation, as a certified small disadvantaged business concern in the database maintained by the Small Business Administration (PROONet); or

___ (ii) It has submitted a completed application to the Small Business Administration or a Private Certifier to be certified as a small disadvantaged business concern in accordance with 13 CFR 124, Subpart B, and a decision on that application is pending, and that no material change in disadvantaged ownership and control has occurred since its application was submitted.

(2)___ For Joint Ventures. The offeror represents, as part of its offer, that it is a joint venture that complies with the requirements at 13 CFR 124.1002(f) and that the representation in paragraph (b)(1) of this provision is accurate for the small disadvantaged business concern that is participating in the joint venture. [The offeror shall enter the name of the small disadvantaged business concern that is participating in the joint venture: _____.]

(c) Penalties and Remedies. Anyone who misrepresents any aspects of the disadvantaged status of a concern for the purposes of securing a contract or subcontract shall:

(1) Be punished by imposition of a fine, imprisonment, or both;

(2) Be subject to administrative remedies, including suspension and debarment; and

(3) Be ineligible for participation in programs conducted under the authority of the Small Business Act.

(End of provision)

52.222-22 PREVIOUS CONTRACTS AND COMPLIANCE REPORTS (FEB 1999)

The offeror represents that --

(a) () It has, () has not participated in a previous contract or subcontract subject to the Equal Opportunity clause of this solicitation;

(b) () It has, () has not, filed all required compliance reports; and

(c) Representations indicating submission of required compliance reports, signed by proposed subcontractors, will

be obtained before subcontract awards.

(End of provision)

52.222-38 COMPLIANCE WITH VETERANS' EMPLOYMENT REPORTING REQUIREMENTS (DEC 2001)

By submission of its offer, the offeror represents that, if it is subject to the reporting requirements of 38 U.S.C. 4212(d) (i.e., if it has any contract containing Federal Acquisition Regulation clause 52.222-37, Employment Reports on Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans), it has submitted the most recent VETS-100 Report required by that clause.

(End of provision)

52.223-4 RECOVERED MATERIAL CERTIFICATION (OCT 1997)

As required by the Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6962(c)(3)(A)(i)), the offeror certifies, by signing this offer, that the percentage of recovered materials to be used in the performance of the contract will be at least the amount required by the applicable contract specifications.

(End of provision)

52.223-13 CERTIFICATION OF TOXIC CHEMICAL RELEASE REPORTING (AUG 2003)

(a) Executive Order 13148, of April 21, 2000, Greening the Government through Leadership in Environmental Management, requires submission of this certification as a prerequisite for contract award.

(b) By signing this offer, the offeror certifies that--

(1) As the owner or operator of facilities that will be used in the performance of this contract that are subject to the filing and reporting requirements described in section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023) and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106), the offeror will file and continue to file for such facilities for the life of the contract the Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of EPCRA and section 6607 of PPA; or

(2) None of its owned or operated facilities to be used in the performance of this contract is subject to the Form R filing and reporting requirements because each such facility is exempt for at least one of the following reasons: (Check each block that is applicable.)

() (i) The facility does not manufacture, process, or otherwise use any toxic chemicals listed in 40 CFR 372.65;

() (ii) The facility does not have 10 or more full-time employees as specified in section 313.(b)(1)(A) of EPCRA 42 U.S.C. 11023(b)(1)(A);

() (iii) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

() (iv) The facility does not fall within the following Standard Industrial Classification (SIC) codes or their corresponding North American Industry Classification System sectors:

(A) Major group code 10 (except 1011, 1081, and 1094.

(B) Major group code 12 (except 1241).

(C) Major group codes 20 through 39.

(D) Industry code 4911, 4931, or 4939 (limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce).

(E) Industry code 4953 (limited to facilities regulated under the Resource Conservation and Recovery Act, Subtitle C (42 U.S.C. 6921, et seq.), 5169, 5171, or 7389 (limited to facilities primarily engaged in solvent recovery services on a contract or fee basis); or

() (v) The facility is not located within the United States or its outlying areas.

(End of clause)

252.209-7001 DISCLOSURE OF OWNERSHIP OR CONTROL BY THE GOVERNMENT OF A TERRORIST COUNTRY (SEP 2004)

(a) "Definitions."

As used in this provision --

(a) "Government of a terrorist country" includes the state and the government of a terrorist country, as well as any political subdivision, agency, or instrumentality thereof.

(2) "Terrorist country" means a country determined by the Secretary of State, under section 6(j)(1)(A) of the Export Administration Act of 1979 (50 U.S.C. App. 2405(j)(i)(A)), to be a country the government of which has repeatedly provided support for such acts of international terrorism. As of the date of this provision, terrorist countries subject to this provision include: Cuba, Iran, Libya, North Korea, Sudan, and Syria.

(3) "Significant interest" means --

(i) Ownership of or beneficial interest in 5 percent or more of the firm's or subsidiary's securities. Beneficial interest includes holding 5 percent or more of any class of the firm's securities in "nominee shares," "street names," or some other method of holding securities that does not disclose the beneficial owner;

(ii) Holding a management position in the firm, such as a director or officer;

(iii) Ability to control or influence the election, appointment, or tenure of directors or officers in the firm;

(iv) Ownership of 10 percent or more of the assets of a firm such as equipment, buildings, real estate, or other tangible assets of the firm; or

(v) Holding 50 percent or more of the indebtedness of a firm.

(b) "Prohibition on award."

In accordance with 10 U.S.C. 2327, no contract may be awarded to a firm or a subsidiary of a firm if the government of a terrorist country has a significant interest in the firm or subsidiary or, in the case of a subsidiary, the firm that owns the subsidiary, unless a waiver is granted by the Secretary of Defense.

(c) "Disclosure."

If the government of a terrorist country has a significant interest in the Offeror or a subsidiary of the Offeror, the Offeror shall disclose such interest in an attachment to its offer. If the Offeror is a subsidiary, it shall also disclose any significant interest the government of a terrorist country has in any firm that owns or controls the subsidiary. The disclosure shall include --

- (1) Identification of each government holding a significant interest; and
- (2) A description of the significant interest held by each government.

(End of provision)

252.209-7002 DISCLOSURE OF OWNERSHIP OR CONTROL BY A FOREIGN GOVERNMENT (SEP 1994)

(a) Definitions. As used in this provision--

(1) "Entity controlled by a foreign government" means--

(i) Any domestic or foreign organization or corporation that is effectively owned or controlled by a foreign government; or

(ii) Any individual acting on behalf of a foreign government.

(2) "Effectively owned or controlled" means that a foreign government or any entity controlled by a foreign government has the power, either directly or indirectly, whether exercised or exercisable, to control or influence the election or appointment of the Offeror's officers, directors, partners, regents, trustees, or a majority of the Offeror's board of directors by means, e.g., ownership, contract, or operation of law.

(3) "Foreign government" means any governing body organized and existing under the laws of any country other than the United States and its possessions and trust territories and any agent or instrumentality of that government.

(4) "Proscribed information" means--

(i) Top Secret information;

(ii) Communications Security (COMSEC) information, except classified keys used to operate secure telephone units (STU IIIs);

(iii) Restricted Data as defined in the U.S. Atomic Energy Act of 1954, as amended;

(iv) Special Access Program (SAP) information; or

(v) Sensitive Compartmental Information (SCI).

(b) Prohibition on award. No contract under a national security program may be awarded to a company owned by an entity controlled by a foreign government if that company requires access to proscribed information to perform the contract, unless the Secretary of Defense or designee has waived application of 10 U.S.C.2536(a).

(c) Disclosure.

The Offeror shall disclose any interest a foreign government has in the Offeror when that interest constitutes control by a foreign government as defined in this provision. If the Offeror is a subsidiary, it shall also disclose any reportable interest a foreign government has in any entity that owns or controls the subsidiary, including reportable interest concerning the Offeror's immediate parent, intermediate parents, and the ultimate parent. Use separate paper as needed, and provide the information in the following format:

Offeror's Point of Contact for Questions about Disclosure

(Name and Phone Number with Country Code, City Code and Area Code, as applicable)

Name and Address of Offeror

Name and Address of Entity
Controlled by a Foreign Government

Description of Interest, Ownership
Percentage, and Identification of
Foreign Government

(End of provision)

252.247-7022 REPRESENTATION OF EXTENT OF TRANSPORTATION BY SEA (AUG 1992)

(a) The Offeror shall indicate by checking the appropriate blank in paragraph (b) of this provision whether transportation of supplies by sea is anticipated under the resultant contract. The term supplies is defined in the Transportation of Supplies by Sea clause of this solicitation.

(b) Representation. The Offeror represents that it:

____ (1) Does anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

____ (2) Does not anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

(c) Any contract resulting from this solicitation will include the Transportation of Supplies by Sea clause. If the Offeror represents that it will not use ocean transportation, the resulting contract will also include the Defense FAR Supplement clause at 252.247-7024, Notification of Transportation of Supplies by Sea.

(End of provision)

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SUBMIT THE FOLLOWING INFORMATION WITH YOUR OFFER
NOTICE TO OFFERORS REGARDING PRE-AWARD INFORMATION

It is requested that the following information be provided with your bid:

1. Company Name and Address: _____

2. Point of Contact:

Name: _____ Phone: (_____) _____

Alt Phone: (_____) _____ Fax: (_____) _____
3. Electronic Transfer Payments will now be required for all new contracts. Do you currently receive Electronic Transfer Payments from this agency? (agency codes 00005524/00006482)

Yes() NO()
4. Name of Bank and Branch _____

Personal Banker _____

Telephone Number _____

Fax Number _____
5. Name of Bonding Agent Company _____

Agents Name _____

Telephone _____
6. List three projects that are substantially complete or have been completed within the last two years that are similar to this project. Projects should be listed in the following order: Federal Projects, state projects, city and county projects, than commercial projects. Please provide in the following format:
 - a) Title & Location of Project _____

Agency/Company _____

Award Amount _____

Point of Contact (Name & Title) _____

Telephone Number _____
Year of Completion _____

b) Title & Location of Project _____
Agency/Company _____
Award Amount _____
Point of Contact (Name & Title) _____
Telephone Number _____
Year of Completion _____

c) Title & Location of Project _____
Agency/Company _____
Award Amount _____
Point of Contact (Name & Title) _____
Telephone Number _____
Year of Completion _____

7) List all outstanding uncompleted projects, in the following format:

a) Title of Project _____
Agency/Company _____
Est. Completion Date _____
Award Amount _____

b) Title of Project _____
Agency/Company _____
Est. Completion Date _____
Award Amount _____

c) Title of Project _____
Agency/Company _____
Est. Completion Date _____
Award Amount _____

END OF SECTION 00600

Section 00700 - Contract Clauses

52.202-1	Definitions	JUL 2004
52.203-3	Gratuities	APR 1984
52.203-5	Covenant Against Contingent Fees	APR 1984
52.203-7	Anti-Kickback Procedures	JUL 1995
52.203-8	Cancellation, Rescission, and Recovery of Funds for Illegal or Improper Activity	JAN 1997
52.203-10	Price Or Fee Adjustment For Illegal Or Improper Activity	JAN 1997
52.203-12	Limitation On Payments To Influence Certain Federal Transactions	JUN 2003
52.204-2 Alt II	Security Requirements (Aug 1996) - Alternate II	APR 1984
52.204-4	Printed or Copied Double-Sided on Recycled Paper	AUG 2000
52.209-6	Protecting the Government's Interest When Subcontracting With Contractors Debarred, Suspended, or Proposed for Debarment	JAN 2005
52.215-11	Price Reduction for Defective Cost or Pricing Data--Modifications	OCT 1997
52.215-13	Subcontractor Cost or Pricing Data--Modifications	OCT 1997
52.219-4	Notice of Price Evaluation Preference for HUBZone Small Business Concerns	OCT 2004
52.219-8	Utilization of Small Business Concerns	MAY 2004
52.219-9 Alt II	Small Business Subcontracting Plan (Jan 2002) Alternate II	OCT 2001
52.219-16	Liquidated Damages-Subcontracting Plan	JAN 1999
52.219-25	Small Disadvantaged Business Participation Program--Disadvantaged Status and Reporting	OCT 1999
52.222-1	Notice To The Government Of Labor Disputes	FEB 1997
52.222-3	Convict Labor	JUN 2003
52.222-4	Contract Work Hours and Safety Standards Act - Overtime Compensation	SEP 2000
52.222-6	Davis Bacon Act	FEB 1995
52.222-7	Withholding of Funds	FEB 1988
52.222-8	Payrolls and Basic Records	FEB 1988
52.222-9	Apprentices and Trainees	FEB 1988
52.222-10	Compliance with Copeland Act Requirements	FEB 1988
52.222-11	Subcontracts (Labor Standards)	FEB 1988
52.222-12	Contract Termination-Debarment	FEB 1988
52.222-13	Compliance with Davis -Bacon and Related Act Regulations.	FEB 1988
52.222-14	Disputes Concerning Labor Standards	FEB 1988
52.222-15	Certification of Eligibility	FEB 1988
52.222-21	Prohibition Of Segregated Facilities	FEB 1999
52.222-26	Equal Opportunity	APR 2002
52.222-27	Affirmative Action Compliance Requirements for Construction	FEB 1999
52.222-35	Equal Opportunity For Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans	DEC 2001
52.222-36	Affirmative Action For Workers With Disabilities	JUN 1998
52.222-37	Employment Reports On Special Disabled Veterans, Veterans Of The Vietnam Era, and Other Eligible Veterans	DEC 2001
52.223-3	Hazardous Material Identification And Material Safety Data	JAN 1997
52.223-5	Pollution Prevention and Right-to-Know Information	AUG 2003
52.223-9	Estimate of Percentage of Recovered Material Content for EPA-Designated Products	AUG 2000

52.223-14	Toxic Chemical Release Reporting	AUG 2003
52.225-9	Buy American Act--Construction Materials	JAN 2005
52.225-10	Notice of Buy American Act Requirement--Construction Materials	MAY 2002
52.225-13	Restrictions on Certain Foreign Purchases	DEC 2003
52.227-1	Authorization and Consent	JUL 1995
52.227-2	Notice And Assistance Regarding Patent And Copyright Infringement	AUG 1996
52.227-4	Patent Indemnity-Construction Contracts	APR 1984
52.228-2	Additional Bond Security	OCT 1997
52.228-11	Pledges Of Assets	FEB 1992
52.228-12	Prospective Subcontractor Requests for Bonds	OCT 1995
52.228-14	Irrevocable Letter of Credit	DEC 1999
52.228-15	Performance and Payment Bonds--Construction	JUL 2000
52.232-5	Payments under Fixed-Price Construction Contracts	SEP 2002
52.232-17	Interest	JUN 1996
52.232-23 Alt I	Assignment of Claims (Jan 1986) - Alternate I	APR 1984
52.232-27	Prompt Payment for Construction Contracts	OCT 2003
52.232-33	Payment by Electronic Funds Transfer--Central Contractor Registration	OCT 2003
52.233-1	Disputes	JUL 2002
52.233-3	Protest After Award	AUG 1996
52.236-2	Differing Site Conditions	APR 1984
52.236-3	Site Investigation and Conditions Affecting the Work	APR 1984
52.236-5	Material and Workmanship	APR 1984
52.236-6	Superintendence by the Contractor	APR 1984
52.236-7	Permits and Responsibilities	NOV 1991
52.236-8	Other Contracts	APR 1984
52.236-9	Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements	APR 1984
52.236-10	Operations and Storage Areas	APR 1984
52.236-11	Use and Possession Prior to Completion	APR 1984
52.236-12	Cleaning Up	APR 1984
52.236-13	Accident Prevention	NOV 1991
52.236-14	Availability and Use of Utility Services	APR 1984
52.236-15	Schedules for Construction Contracts	APR 1984
52.236-17	Layout of Work	APR 1984
52.236-21	Specifications and Drawings for Construction	FEB 1997
52.236-26	Preconstruction Conference	FEB 1995
52.242-13	Bankruptcy	JUL 1995
52.242-14	Suspension of Work	APR 1984
52.243-4	Changes	AUG 1987
52.246-12	Inspection of Construction	AUG 1996
52.246-21 Alt I	Warranty of Construction (Mar 1994) - Alternate I	APR 1984
52.248-3	Value Engineering-Construction	FEB 2000
52.249-2 Alt I	Termination for Convenience of the Government (Fixed-Price) (May 2004) - Alternate I	SEP 1996
52.249-10	Default (Fixed-Price Construction)	APR 1984
52.253-1	Computer Generated Forms	JAN 1991
252.201-7000	Contracting Officer's Representative	DEC 1991
252.203-7001	Prohibition On Persons Convicted of Fraud or Other Defense-Contract-Related Felonies	DEC 2004
252.203-7002	Display Of DOD Hotline Poster	DEC 1991

252.204-7000	Disclosure Of Information	DEC 1991
252.204-7003	Control Of Government Personnel Work Product	APR 1992
252.204-7004 Alt A	Required Central Contractor Registration (52.204-7) Alternate A	NOV 2003
252.205-7000	Provision Of Information To Cooperative Agreement Holders	DEC 1991
252.209-7001	Disclosure of Ownership or Control by the Government of a Terrorist Country	SEP 2004
252.209-7004	Subcontracting With Firms That Are Owned or Controlled By The Government of a Terrorist Country	MAR 1998
252.215-7000	Pricing Adjustments	DEC 1991
252.219-7003	Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan (DOD Contracts)	APR 1996
252.223-7006	Prohibition On Storage And Disposal Of Toxic And Hazardous Materials	APR 1993
252.225-7031	Secondary Arab Boycott Of Israel	APR 2003
252.226-7001	Utilization of Indian Organizations and Indian-Owned Economic Enterprises, and Native Hawaiian Small Business Concerns	SEP 2004
252.227-7023	Drawings and Other Data to become Property of Government	MAR 1979
252.227-7033	Rights in Shop Drawings	APR 1966
252.231-7000	Supplemental Cost Principles	DEC 1991
252.236-7000	Modification Proposals -Price Breakdown	DEC 1991
252.242-7000	Postaward Conference	DEC 1991
252.243-7001	Pricing Of Contract Modifications	DEC 1991
252.243-7002	Requests for Equitable Adjustment	MAR 1998
52.201-4001	Successor Contracting Officers	DEC 1999
52.212-4007	Environmental Litigation	NOV 1999
PIL 2003-06	Security Contract Language for all Corps of Engineers' Unclassified Contracts	FEB 2003

CLAUSES INCORPORATED BY FULL TEXT

52.202-1 DEFINITIONS (JUL 2004)

(a) When a solicitation provision or contract clause uses a word or term that is defined in the Federal Acquisition Regulation (FAR), the word or term has the same meaning as the definition in FAR 2.101 in effect at the time the solicitation was issued, unless--

- (1) The solicitation, or amended solicitation, provides a different definition;
- (2) The contracting parties agree to a different definition;
- (3) The part, subpart, or section of the FAR where the provision or clause is prescribed provides a different meaning; or
- (4) The word or term is defined in FAR Part 31, for use in the cost principles and procedures.

(b) The FAR Index is a guide to words and terms the FAR defines and shows where each definition is located. The FAR Index is available via the Internet at <http://www.acqnet.gov> at the end of the FAR, after the FAR Appendix.

(End of clause)

52.203-3 GRATUITIES (APR 1984)

(a) The right of the Contractor to proceed may be terminated by written notice if, after notice and hearing, the agency head or a designee determines that the Contractor, its agent, or another representative--

(1) Offered or gave a gratuity (e.g., an entertainment or gift) to an officer, official, or employee of the Government; and

(2) Intended, by the gratuity, to obtain a contract or favorable treatment under a contract.

(b) The facts supporting this determination may be reviewed by any court having lawful jurisdiction.

(c) If this contract is terminated under paragraph (a) of this clause, the Government is entitled--

(1) To pursue the same remedies as in a breach of the contract; and

(2) In addition to any other damages provided by law, to exemplary damages of not less than 3 nor more than 10 times the cost incurred by the Contractor in giving gratuities to the person concerned, as determined by the agency head or a designee. (This subparagraph (c)(2) is applicable only if this contract uses money appropriated to the Department of Defense.)

(d) The rights and remedies of the Government provided in this clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

52.203-5 COVENANT AGAINST CONTINGENT FEES (APR 1984)

(a) The Contractor warrants that no person or agency has been employed or retained to solicit or obtain this contract upon an agreement or understanding for a contingent fee, except a bona fide employee or agency. For breach or violation of this warranty, the Government shall have the right to annul this contract without liability or, in its discretion, to deduct from the contract price or consideration, or otherwise recover, the full amount of the contingent fee.

(b) "Bona fide agency," as used in this clause, means an established commercial or selling agency, maintained by a contractor for the purpose of securing business, that neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds itself out as being able to obtain any Government contract or contracts through improper influence.

"Bona fide employee," as used in this clause, means a person, employed by a contractor and subject to the contractor's supervision and control as to time, place, and manner of performance, who neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds out as being able to obtain any Government contract or contracts through improper influence.

"Contingent fee," as used in this clause, means any commission, percentage, brokerage, or other fee that is

contingent upon the success that a person or concern has in securing a Government contract.

"Improper influence," as used in this clause, means any influence that induces or tends to induce a Government employee or officer to give consideration or to act regarding a Government contract on any basis other than the merits of the matter.

(End of clause)

52.203-7 ANTI-KICKBACK PROCEDURES. (JUL 1995)

(a) Definitions.

"Kickback," as used in this clause, means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided, directly or indirectly, to any prime Contractor, prime Contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contract or in connection with a subcontract relating to a prime contract.

"Person," as used in this clause, means a corporation, partnership, business association of any kind, trust, joint-stock company, or individual.

"Prime contract," as used in this clause, means a contract or contractual action entered into by the United States for the purpose of obtaining supplies, materials, equipment, or services of any kind.

"Prime Contractor," as used in this clause, means a person who has entered into a prime contract with the United States.

"Prime Contractor employee," as used in this clause, means any officer, partner, employee, or agent of a prime Contractor.

"Subcontract," as used in this clause, means a contract or contractual action entered into by a prime Contractor or subcontractor for the purpose of obtaining supplies, materials, equipment, or services of any kind under a prime contract.

"Subcontractor," as used in this clause, (1) means any person, other than the prime Contractor, who offers to furnish or furnishes any supplies, materials, equipment, or services of any kind under a prime contract or a subcontract entered into in connection with such prime contract, and (2) includes any person who offers to furnish or furnishes general supplies to the prime Contractor or a higher tier subcontractor.

"Subcontractor employee," as used in this clause, means any officer, partner, employee, or agent of a subcontractor.

(b) The Anti-Kickback Act of 1986 (41 U.S.C. 51-58) (the Act), prohibits any person from -

(1) Providing or attempting to provide or offering to provide any kickback;

(2) Soliciting, accepting, or attempting to accept any kickback; or

(3) Including, directly or indirectly, the amount of any kickback in the contract price charged by a prime Contractor to the United States or in the contract price charged by a subcontractor to a prime Contractor or higher tier subcontractor.

(c)(1) The Contractor shall have in place and follow reasonable procedures designed to prevent and detect possible violations described in paragraph (b) of this clause in its own operations and direct business relationships.

(2) When the Contractor has reasonable grounds to believe that a violation described in paragraph (b) of this clause may have occurred, the Contractor shall promptly report in writing the possible violation. Such reports shall be made to the inspector general of the contracting agency, the head of the contracting agency if the agency does not have an inspector general, or the Department of Justice.

(3) The Contractor shall cooperate fully with any Federal agency investigating a possible violation described in paragraph (b) of this clause.

(4) The Contracting Officer may (i) offset the amount of the kickback against any monies owed by the United States under the prime contract and/or (ii) direct that the Prime Contractor withhold, from sums owed a subcontractor under the prime contract, the amount of any kickback. The Contracting Officer may order the monies withheld under subdivision (c)(4)(ii) of this clause be paid over to the Government unless the Government has already offset those monies under subdivision (c)(4)(i) of this clause. In either case, the Prime Contractor shall notify the Contracting Officer when the monies are withheld.

(5) The Contractor agrees to incorporate the substance of this clause, including this subparagraph (c)(5) but excepting subparagraph (c)(1), in all subcontracts under this contract which exceed \$100,000.

52.203-8 CANCELLATION, RESCISSION, AND RECOVERY OF FUNDS FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997)

(a) If the Government receives information that a contractor or a person has engaged in conduct constituting a violation of subsection (a), (b), (c), or (d) of Section 27 of the Office of Federal Procurement Policy Act (41 U.S.C. 423) (the Act), as amended by section 4304 of the 1996 National Defense Authorization Act for Fiscal Year 1996 (Pub. L. 104-106), the Government may--

(1) Cancel the solicitation, if the contract has not yet been awarded or issued; or

(2) Rescind the contract with respect to which--

(i) The Contractor or someone acting for the Contractor has been convicted for an offense where the conduct constitutes a violation of subsection 27(a) or (b) of the Act for the purpose of either--

(A) Exchanging the information covered by such subsections for anything of value; or

(B) Obtaining or giving anyone a competitive advantage in the award of a Federal agency procurement contract; or

(ii) The head of the contracting activity has determined, based upon a preponderance of the evidence, that the Contractor or someone acting for the Contractor has engaged in conduct constituting an offense punishable under subsections 27(e)(1) of the Act.

(b) If the Government rescinds the contract under paragraph (a) of this clause, the Government is entitled to recover, in addition to any penalty prescribed by law, the amount expended under the contract.

(c) The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law, regulation, or under this contract.

(End of clause)

52.203-10 PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997)

(a) The Government, at its election, may reduce the price of a fixed-price type contract and the total cost and fee under a cost-type contract by the amount of profit or fee determined as set forth in paragraph (b) of this clause if the head of the contracting activity or designee determines that there was a violation of subsection 27 (a), (b), or (c) of the Office of Federal Procurement Policy Act, as amended (41 U.S.C. 423), as implemented in section 3.104 of the Federal Acquisition Regulation.

(b) The price or fee reduction referred to in paragraph (a) of this clause shall be--

(1) For cost-plus-fixed-fee contracts, the amount of the fee specified in the contract at the time of award;

(2) For cost-plus-incentive-fee contracts, the target fee specified in the contract at the time of award, notwithstanding any minimum fee or "fee floor" specified in the contract;

(3) For cost-plus-award-fee contracts--

(i) The base fee established in the contract at the time of contract award;

(ii) If no base fee is specified in the contract, 30 percent of the amount of each award fee otherwise payable to the Contractor for each award fee evaluation period or at each award fee determination point.

(4) For fixed-price-incentive contracts, the Government may--

(i) Reduce the contract target price and contract target profit both by an amount equal to the initial target profit specified in the contract at the time of contract award; or

(ii) If an immediate adjustment to the contract target price and contract target profit would have a significant adverse impact on the incentive price revision relationship under the contract, or adversely affect the contract financing provisions, the Contracting Officer may defer such adjustment until establishment of the total final price of the contract. The total final price established in accordance with the incentive price revision provisions of the contract shall be reduced by an amount equal to the initial target profit specified in the contract at the time of contract award and such reduced price shall be the total final contract price.

(5) For firm-fixed-price contracts, by 10 percent of the initial contract price or a profit amount determined by the Contracting Officer from records or documents in existence prior to the date of the contract award.

(c) The Government may, at its election, reduce a prime contractor's price or fee in accordance with the procedures of paragraph (b) of this clause for violations of the Act by its subcontractors by an amount not to exceed the amount of profit or fee reflected in the subcontract at the time the subcontract was first definitively priced.

(d) In addition to the remedies in paragraphs (a) and (c) of this clause, the Government may terminate this contract for default. The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

52.203-12 LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (JUN 2003)

(a) Definitions.

"Agency," as used in this clause, means executive agency as defined in 2.101.

"Covered Federal action," as used in this clause, means any of the following Federal actions:

- (1) The awarding of any Federal contract.
- (2) The making of any Federal grant.
- (3) The making of any Federal loan.
- (4) The entering into of any cooperative agreement.
- (5) The extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

"Indian tribe" and "tribal organization," as used in this clause, have the meaning provided in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450B) and include Alaskan Natives.

"Influencing or attempting to influence," as used in this clause, means making, with the intent to influence, any communication to or appearance before an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any covered Federal action.

"Local government," as used in this clause, means a unit of government in a State and, if chartered, established, or otherwise recognized by a State for the performance of a governmental duty, including a local public authority, a special district, an intrastate district, a council of governments, a sponsor group representative organization, and any other instrumentality of a local government.

"Officer or employee of an agency," as used in this clause, includes the following individuals who are employed by an agency:

- (1) An individual who is appointed to a position in the Government under Title 5, United States Code, including a position under a temporary appointment.
- (2) A member of the uniformed services, as defined in subsection 101(3), Title 37, United States Code.
- (3) A special Government employee, as defined in section 202, Title 18, United States Code.
- (4) An individual who is a member of a Federal advisory committee, as defined by the Federal Advisory Committee Act, Title 5, United States Code, appendix 2.

"Person," as used in this clause, means an individual, corporation, company, association, authority, firm, partnership, society, State, and local government, regardless of whether such entity is operated for profit, or not for profit. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Reasonable compensation," as used in this clause, means, with respect to a regularly employed officer or employee of any person, compensation that is consistent with the normal compensation for such officer or employee for work that is not furnished to, not funded by, or not furnished in cooperation with the Federal Government.

"Reasonable payment," as used in this clause, means, with respect to professional and other technical services, a payment in an amount that is consistent with the amount normally paid for such services in the private sector.

"Recipient," as used in this clause, includes the Contractor and all subcontractors. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Regularly employed," as used in this clause, means, with respect to an officer or employee of a person requesting or receiving a Federal contract, an officer or employee who is employed by such person for at least 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person for receipt of such contract. An officer or employee who is employed by such person for less than 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person shall be considered to be regularly employed as soon as he or she is employed by such person for 130 working days.

State, as used in this clause, means a State of the United States, the District of Columbia, or an outlying area of the United States, an agency or instrumentality of a State, and multi-State, regional, or interstate entity having governmental duties and powers.

(b) Prohibitions.

(1) Section 1352 of Title 31, United States Code, among other things, prohibits a recipient of a Federal contract, grant, loan, or cooperative agreement from using appropriated funds to pay any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any of the following covered Federal actions: the awarding of any Federal contract; the making of any Federal grant; the making of any Federal loan; the entering into of any cooperative agreement; or the modification of any Federal contract, grant, loan, or cooperative agreement.

(2) The Act also requires Contractors to furnish a disclosure if any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a Federal contract, grant, loan, or cooperative agreement.

(3) The prohibitions of the Act do not apply under the following conditions:

(i) Agency and legislative liaison by own employees.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of a payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action if the payment is for agency and legislative liaison activities not directly related to a covered Federal action.

(B) For purposes of subdivision (b)(3)(i)(A) of this clause, providing any information specifically requested by an agency or Congress is permitted at any time.

(C) The following agency and legislative liaison activities are permitted at any time where they are not related to a specific solicitation for any covered Federal action:

(1) Discussing with an agency the qualities and characteristics (including individual demonstrations) of the person's products or services, conditions or terms of sale, and service capabilities.

(2) Technical discussions and other activities regarding the application or adaptation of the person's products or services for an agency's use.

(D) The following agency and legislative liaison activities are permitted where they are prior to formal solicitation of any covered Federal action--

(1) Providing any information not specifically requested but necessary for an agency to make an informed decision about initiation of a covered Federal action;

(2) Technical discussions regarding the preparation of an unsolicited proposal prior to its official submission; and

(3) Capability presentations by persons seeking awards from an agency pursuant to the provisions of the Small Business Act, as amended by Pub. L. 95-507, and subsequent amendments.

(E) Only those services expressly authorized by subdivision (b)(3)(i)(A) of this clause are permitted under this clause.

(ii) Professional and technical services.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of--

(1) A payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action, if payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action.

(2) Any reasonable payment to a person, other than an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action if the payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action. Persons other than officers or employees of a person requesting or receiving a covered Federal action include consultants and trade associations.

(B) For purposes of subdivision (b)(3)(ii)(A) of this clause, "professional and technical services" shall be limited to advice and analysis directly applying any professional or technical discipline. For example, drafting of a legal document accompanying a bid or proposal by a lawyer is allowable. Similarly, technical advice provided by an engineer on the performance or operational capability of a piece of equipment rendered directly in the negotiation of a contract is allowable. However, communications with the intent to influence made by a professional (such as a licensed lawyer) or a technical person (such as a licensed accountant) are not allowable under this section unless they provide advice and analysis directly applying their professional or technical expertise and unless the advice or analysis is rendered directly and solely in the preparation, submission or negotiation of a covered Federal action. Thus, for example, communications with the intent to influence made by a lawyer that do not provide legal advice or analysis directly and solely related to the legal aspects of his or her client's proposal, but generally advocate one proposal over another are not allowable under this section because the lawyer is not providing professional legal services. Similarly, communications with the intent to influence made by an engineer providing an engineering analysis prior to the preparation or submission of a bid or proposal are not allowable under this section since the engineer is providing technical services but not directly in the preparation, submission or negotiation of a covered Federal action.

(C) Requirements imposed by or pursuant to law as a condition for receiving a covered Federal award include those required by law or regulation and any other requirements in the actual award documents.

(D) Only those services expressly authorized by subdivisions (b)(3)(ii)(A)(1) and (2) of this clause are permitted under this clause.

(E) The reporting requirements of FAR 3.803(a) shall not apply with respect to payments of reasonable compensation made to regularly employed officers or employees of a person.

(c) Disclosure.

(1) The Contractor who requests or receives from an agency a Federal contract shall file with that agency a disclosure form, OMB standard form LLL, Disclosure of Lobbying Activities, if such person has made or has agreed to make any payment using nonappropriated funds (to include profits from any covered Federal action), which would be prohibited under subparagraph (b)(1) of this clause, if paid for with appropriated funds.

(2) The Contractor shall file a disclosure form at the end of each calendar quarter in which there occurs any event that materially affects the accuracy of the information contained in any disclosure form previously filed by such person under subparagraph (c)(1) of this clause. An event that materially affects the accuracy of the information reported includes--

(i) A cumulative increase of \$25,000 or more in the amount paid or expected to be paid for influencing or attempting to influence a covered Federal action; or

(ii) A change in the person(s) or individual(s) influencing or attempting to influence a covered Federal action; or

(iii) A change in the officer(s), employee(s), or Member(s) contacted to influence or attempt to influence a covered Federal action.

(3) The Contractor shall require the submittal of a certification, and if required, a disclosure form by any person who requests or receives any subcontract exceeding \$100,000 under the Federal contract.

(4) All subcontractor disclosure forms (but not certifications) shall be forwarded from tier to tier until received by the prime Contractor. The prime Contractor shall submit all disclosures to the Contracting Officer at the end of the calendar quarter in which the disclosure form is submitted by the subcontractor. Each subcontractor certification shall be retained in the subcontract file of the awarding Contractor.

(d) Agreement. The Contractor agrees not to make any payment prohibited by this clause.

(e) Penalties.

(1) Any person who makes an expenditure prohibited under paragraph (a) of this clause or who fails to file or amend the disclosure form to be filed or amended by paragraph (b) of this clause shall be subject to civil penalties as provided for by 31 U.S.C. 1352. An imposition of a civil penalty does not prevent the Government from seeking any other remedy that may be applicable.

(2) Contractors may rely without liability on the representation made by their subcontractors in the certification and disclosure form.

(f) Cost allowability. Nothing in this clause makes allowable or reasonable any costs which would otherwise be unallowable or unreasonable. Conversely, costs made specifically unallowable by the requirements in this clause will not be made allowable under any other provision.

(End of clause)

(a) This clause applies to the extent that this contract involves access to information classified "Confidential," "Secret," or "Top Secret."

(b) The Contractor shall comply with (1) the Security Agreement (DD Form 441), including the National Industrial Security Program Operating Manual (DOD 5220.22-M); and (2) any revisions to that manual, notice of which has been furnished to the Contractor.

(c) If, subsequent to the date of this contract, the security classification or security requirements under this contract are changed by the Government and if the changes cause an increase or decrease in security costs or otherwise affect any other term or condition of this contract, the contract shall be subject to an equitable adjustment as if the changes were directed under the Changes clause of this contract.

(d) The Contractor agrees to insert terms that conform substantially to the language of this clause, including this paragraph (d) but excluding any reference to the Changes clause of this contract, in all subcontracts under this contract that involve access to classified information.

(e) The Contractor shall be responsible for furnishing to each employee and for requiring each employee engaged on the work to display such identification as may be approved and directed by the Contracting Officer. All prescribed identification shall immediately be delivered to the Contracting Officer, for cancellation upon the release of any employee. When required by the Contracting Officer, the Contractor shall obtain and submit fingerprints of all persons employed or to be employed on the project.

52.204-4 PRINTED OR COPIED DOUBLE-SIDED ON RECYCLED PAPER (AUG 2000)

(a) Definitions. As used in this clause--

"Postconsumer material" means a material or finished product that has served its intended use and has been discarded for disposal or recovery, having completed its life as a consumer item. Postconsumer material is a part of the broader category of "recovered material." For paper and paper products, postconsumer material means "postconsumer fiber" defined by the U.S. Environmental Protection Agency (EPA) as--

(1) Paper, paperboard, and fibrous materials from retail stores, office buildings, homes, and so forth, after they have passed through their end-usage as a consumer item, including: used corrugated boxes; old newspapers; old magazines; mixed waste paper; tabulating cards; and used cordage; or

(2) All paper, paperboard, and fibrous materials that enter and are collected from municipal solid waste; but not

(3) Fiber derived from printers' over-runs, converters' scrap, and over-issue publications.

"Printed or copied double-sided" means printing or reproducing a document so that information is on both sides of a sheet of paper.

"Recovered material," for paper and paper products, is defined by EPA in its Comprehensive Procurement Guideline as "recovered fiber" and means the following materials:

(1) Postconsumer fiber; and

(2) Manufacturing wastes such as--

(i) Dry paper and paperboard waste generated after completion of the papermaking process (that is, those manufacturing operations up to and including the cutting and trimming of the paper machine reel into smaller rolls or

rough sheets) including: envelope cuttings, bindery trimmings, and other paper and paperboard waste resulting from printing, cutting, forming, and other converting operations; bag, box, and carton manufacturing wastes; and butt rolls, mill wrappers, and rejected unused stock; and

(ii) Repulped finished paper and paperboard from obsolete inventories of paper and paperboard manufacturers, merchants, wholesalers, dealers, printers, converters, or others.

(b) In accordance with Section 101 of Executive Order 13101 of September 14, 1998, Greening the Government through Waste Prevention, Recycling, and Federal Acquisition, the Contractor is encouraged to submit paper documents, such as offers, letters, or reports, that are printed or copied double-sided on recycled paper that meet minimum content standards specified in Section 505 of Executive Order 13101, when not using electronic commerce methods to submit information or data to the Government.

(c) If the Contractor cannot purchase high-speed copier paper, offset paper, forms bond, computer printout paper, carbonless paper, file folders, white wove envelopes, writing and office paper, book paper, cotton fiber paper, and cover stock meeting the 30 percent postconsumer material standard for use in submitting paper documents to the Government, it should use paper containing no less than 20 percent postconsumer material. This lesser standard should be used only when paper meeting the 30 percent postconsumer material standard is not obtainable at a reasonable price or does not meet reasonable performance standards.

(End of clause)

52.209-6 PROTECTING THE GOVERNMENT'S INTEREST WHEN SUBCONTRACTING WITH CONTRACTORS DEBARRED, SUSPENDED, OR PROPOSED FOR DEBARMENT (JAN 2005)

(a) The Government suspends or debar Contractors to protect the Government's interests. The Contractor shall not enter into any subcontract in excess of the \$25,000 with a Contractor that is debarred, suspended, or proposed for debarment unless there is a compelling reason to do so.

(b) The Contractor shall require each proposed first-tier subcontractor, whose subcontract will exceed \$25,000, to disclose to the Contractor, in writing, whether as of the time of award of the subcontract, the subcontractor, or its principles, is or is not debarred, suspended, or proposed for debarment by the Federal Government.

(c) A corporate officer or a designee of the Contractor shall notify the Contracting Officer, in writing, before entering into a subcontract with a party that is debarred, suspended, or proposed for debarment (see FAR 9.404 for information on the in the Excluded Parties List System). The notice must include the following:

(1) The name of the subcontractor.

(2) The Contractor's knowledge of the reasons for the subcontractor being in the Excluded Parties List System.

(3) The compelling reason(s) for doing business with the subcontractor notwithstanding its inclusion in the Excluded Parties List System.

(4) The systems and procedures the Contractor has established to ensure that it is fully protecting the Government's interests when dealing with such subcontractor in view of the specific basis for the party's debarment, suspension, or proposed debarment.

(End of clause)

52.215-11 PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA--MODIFICATIONS (OCT 1997)

(a) This clause shall become operative only for any modification to this contract involving a pricing adjustment expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4, except that this clause does not apply to any modification if an exception under FAR 15.403-1 applies.

(b) If any price, including profit or fee, negotiated in connection with any modification under this clause, or any cost reimbursable under this contract, was increased by any significant amount because (1) the Contractor or a subcontractor furnished cost or pricing data that were not complete, accurate, and current as certified in its Certificate of Current Cost or Pricing Data, (2) a subcontractor or prospective subcontractor furnished the Contractor cost or pricing data that were not complete, accurate, and current as certified in the Contractor's Certificate of Current Cost or Pricing Data, or (3) any of these parties furnished data of any description that were not accurate, the price or cost shall be reduced accordingly and the contract shall be modified to reflect the reduction. This right to a price reduction is limited to that resulting from defects in data relating to modifications for which this clause becomes operative under paragraph (a) of this clause.

(c) Any reduction in the contract price under paragraph (b) of this clause due to defective data from a prospective subcontractor that was not subsequently awarded the subcontract shall be limited to the amount, plus applicable overhead and profit markup, by which--

(1) The actual subcontract; or

(2) The actual cost to the Contractor, if there was no subcontract, was less than the prospective subcontract cost estimate submitted by the Contractor; provided, that the actual subcontract price was not itself affected by defective cost or pricing data.

(d)(1) If the Contracting Officer determines under paragraph (b) of this clause that a price or cost reduction should be made, the Contractor agrees not to raise the following matters as a defense:

(i) The Contractor or subcontractor was a sole source supplier or otherwise was in a superior bargaining position and thus the price of the contract would not have been modified even if accurate, complete, and current cost or pricing data had been submitted.

(ii) The Contracting Officer should have known that the cost or pricing data in issue were defective even though the Contractor or subcontractor took no affirmative action to bring the character of the data to the attention of the Contracting Officer.

(iii) The contract was based on an agreement about the total cost of the contract and there was no agreement about the cost of each item procured under the contract.

(iv) The Contractor or subcontractor did not submit a Certificate of Current Cost or Pricing Data.

(2)(i) Except as prohibited by subdivision (d)(2)(ii) of this clause, an offset in an amount determined appropriate by the Contracting Officer based upon the facts shall be allowed against the amount of a contract price reduction if--

(A) The Contractor certifies to the Contracting Officer that, to the best of the Contractor's knowledge and belief, the Contractor is entitled to the offset in the amount requested; and

(B) The Contractor proves that the cost or pricing data were available before the "as of" date specified on its Certificate of Current Cost or Pricing Data, and that the data were not submitted before such date.

(ii) An offset shall not be allowed if--

(A) The understated data were known by the Contractor to be understated before the “as of” date specified on its Certificate of Current Cost or Pricing Data; or

(B) The Government proves that the facts demonstrate that the contract price would not have increased in the amount to be offset even if the available data had been submitted before the “as of” date specified on its Certificate of Current Cost or Pricing Data.

(e) If any reduction in the contract price under this clause reduces the price of items for which payment was made prior to the date of the modification reflecting the price reduction, the Contractor shall be liable to and shall pay the United States at the time such overpayment is repaid--

(1) Simple interest on the amount of such overpayment to be computed from the date(s) of overpayment to the Contractor to the date the Government is repaid by the Contractor at the applicable underpayment rate effective for each quarter prescribed by the Secretary of the Treasury under 26 U.S.C. 6621(a)(2); and

A penalty equal to the amount of the overpayment, if the Contractor or subcontractor knowingly submitted cost or pricing data that were incomplete, inaccurate, or noncurrent.

(End of clause)

52.215-13 SUBCONTRACTOR COST OR PRICING DATA--MODIFICATIONS (OCT 1997)

(a) The requirements of paragraphs (b) and (c) of this clause shall--

(1) Become operative only for any modification to this contract involving a pricing adjustment expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4; and

(2) Be limited to such modifications.

(b) Before awarding any subcontract expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4, on the date of agreement on price or the date of award, whichever is later; or before pricing any subcontract modification involving a pricing adjustment expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4, the Contractor shall require the subcontractor to submit cost or pricing data (actually or by specific identification in writing), unless an exception under FAR 15.403-1 applies.

(c) The Contractor shall require the subcontractor to certify in substantially the form prescribed in FAR 15.406-2 that, to the best of its knowledge and belief, the data submitted under paragraph (b) of this clause were accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract or subcontract modification.

The Contractor shall insert the substance of this clause, including this paragraph (d), in each subcontract that exceeds the threshold for submission of cost or pricing data at FAR 15.403-4 on the date of agreement on price or the date of award, whichever is later.

(End of clause)

52.219-4 NOTICE OF PRICE EVALUATION PREFERENCE FOR HUBZONE SMALL BUSINESS CONCERNS (OCT 2004)

(a) Definition. HUBZone small business concern, as used in this clause, means a small business concern that appears on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration.

(b) Evaluation preference. (1) Offers will be evaluated by adding a factor of 10 percent to the price of all offers, except-

(i) Offers from HUBZone small business concerns that have not waived the evaluation preference;

(ii) Otherwise successful offers from small business concerns;

(iii) Otherwise successful offers of eligible products under the Trade Agreements Act when the dollar threshold for application of the Act is exceeded (see 25.402 of the Federal Acquisition Regulation (FAR)); and

(iv) Otherwise successful offers where application of the factor would be inconsistent with a Memorandum of Understanding or other international agreement with a foreign government.

(2) The factor of 10 percent shall be applied on a line item basis or to any group of items on which award may be made. Other evaluation factors described in the solicitation shall be applied before application of the factor.

(3) A concern that is both a HUBZone small business concern and a small disadvantaged business concern will receive the benefit of both the HUBZone small business price evaluation preference and the small disadvantaged business price evaluation adjustment (see FAR clause 52.219-23). Each applicable price evaluation preference or adjustment shall be calculated independently against an offeror's base offer.

These individual preference amounts shall be added together to arrive at the total evaluated price for that offer.

(c) Waiver of evaluation preference. A HUBZone small business concern may elect to waive the evaluation preference, in which case the factor will be added to its offer for evaluation purposes. The agreements in paragraph (d) of this clause do not apply if the offeror has waived the evaluation preference.

___ Offeror elects to waive the evaluation preference.

(d) Agreement. A HUBZone small business concern agrees that in the performance of the contract, in the case of a contract for

(1) Services (except construction), at least 50 percent of the cost of personnel for contract performance will be spent for employees of the concern or employees of other HUBZone small business concerns;

(2) Supplies (other than procurement from a nonmanufacturer of such supplies), at least 50 percent of the cost of manufacturing, excluding the cost of materials, will be performed by the concern or other HUBZone small business concerns;

(3) General construction, at least 15 percent of the cost of the contract performance incurred for personnel will be spent on the concern's employees or the employees of other HUBZone small business concerns; or

(4) Construction by special trade contractors, at least 25 percent of the cost of the contract performance incurred for personnel will be spent on the concern's employees or the employees of other HUBZone small business concerns.

(e) A HUBZone joint venture agrees that in the performance of the contract, the applicable percentage specified in paragraph (d) of this clause will be performed by the HUBZone small business participant or participants.

(f) A HUBZone small business concern nonmanufacturer agrees to furnish in performing this contract only end items manufactured or produced by HUBZone small business manufacturer concerns. This paragraph does not apply in connection with construction or service contracts.

(End of clause)

52.219-8 UTILIZATION OF SMALL BUSINESS CONCERNS (MAY 2004)

(a) It is the policy of the United States that small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small business concerns, HUBZone small business concerns, small disadvantaged business concerns, and women-owned small business concerns shall have the maximum practicable opportunity to participate in performing contracts let by any Federal agency, including contracts and subcontracts for subsystems, assemblies, components, and related services for major systems. It is further the policy of the United States that its prime contractors establish procedures to ensure the timely payment of amounts due pursuant to the terms of their subcontracts with small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small business concerns, HUBZone small business concerns, small disadvantaged business concerns, and women-owned small business concerns.

(b) The Contractor hereby agrees to carry out this policy in the awarding of subcontracts to the fullest extent consistent with efficient contract performance. The Contractor further agrees to cooperate in any studies or surveys as may be conducted by the United States Small Business Administration or the awarding agency of the United States as may be necessary to determine the extent of the Contractor's compliance with this clause.

Definitions. As used in this contract--

HUBZone small business concern means a small business concern that appears on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration.

Service-disabled veteran-owned small business concern--

(1) Means a small business concern--

(i) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and

(ii) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a service-disabled veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.

(2) Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service-connected, as defined in 38 U.S.C. 101(16).

Small business concern means a small business as defined pursuant to Section 3 of the Small Business Act and relevant regulations promulgated pursuant thereto.

Small disadvantaged business concern means a small business concern that represents, as part of its offer that--

(1) It has received certification as a small disadvantaged business concern consistent with 13 CFR part 124, subpart B;

- (2) No material change in disadvantaged ownership and control has occurred since its certification;
- (3) Where the concern is owned by one or more individuals, the net worth of each individual upon whom the certification is based does not exceed \$750,000 after taking into account the applicable exclusions set forth at 13 CFR 124.104(c)(2); and
- (4) It is identified, on the date of its representation, as a certified small disadvantaged business in the database maintained by the Small Business Administration (PRO-Net).

Veteran-owned small business concern means a small business concern--

- (1) Not less than 51 percent of which is owned by one or more veterans (as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and
- (2) The management and daily business operations of which are controlled by one or more veterans.

Women-owned small business concern means a small business concern--

- (1) That is at least 51 percent owned by one or more women, or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and
 - (2) Whose management and daily business operations are controlled by one or more women.
- (d) Contractors acting in good faith may rely on written representations by their subcontractors regarding their status as a small business concern, a veteran-owned small business concern, a service-disabled veteran-owned small business concern, a HUBZone small business concern, a small disadvantaged business concern, or a women-owned small business concern.

(End of clause)

52.219-9 SMALL BUSINESS SUBCONTRACTING PLAN (JAN 2002)--ALTERNATE II (OCT 2001).

- (a) This clause does not apply to small business concerns.
- (b) Definitions. As used in this clause--

Commercial item means a product or service that satisfies the definition of commercial item in section 2.101 of the Federal Acquisition Regulation.

Commercial plan means a subcontracting plan (including goals) that covers the offeror's fiscal year and that applies to the entire production of commercial items sold by either the entire company or a portion thereof (e.g., division, plant, or product line).

Individual contract plan means a subcontracting plan that covers the entire contract period (including option periods), applies to a specific contract, and has goals that are based on the offeror's planned subcontracting in support of the specific contract, except that indirect costs incurred for common or joint purposes may be allocated on a prorated basis to the contract.

Master plan means a subcontracting plan that contains all the required elements of an individual contract plan, except goals, and may be incorporated into individual contract plans, provided the master plan has been approved.

Subcontract means any agreement (other than one involving an employer-employee relationship) entered into by a Federal Government prime Contractor or subcontractor calling for supplies or services required for performance of the contract or subcontract.

(c) Proposals submitted in response to this solicitation shall include a subcontracting plan that separately addresses subcontracting with small business, veteran-owner small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns. If the offeror is submitting an individual contract plan, the plan must separately address subcontracting with small business, veteran-owner small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns, with a separate part for the basic contract and separate parts for each option (if any). The plan shall be included in and made a part of the resultant contract. The subcontracting plan shall be negotiated within the time specified by the Contracting Officer. Failure to submit and negotiate a subcontracting plan shall make the offeror ineligible for award of a contract.

(d) The offeror's subcontracting plan shall include the following:

(1) Goals, expressed in terms of percentages of total planned subcontracting dollars, for the use of small business, veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns as subcontractors. The offeror shall include all subcontracts that contribute to contract performance, and may include a proportionate share of products and services that are normally allocated as indirect costs.

(2) A statement of--

(i) Total dollars planned to be subcontracted for an individual contract plan; or the offeror's total projected sales, expressed in dollars, and the total value of projected subcontracts to support the sales for a commercial plan;

(ii) Total dollars planned to be subcontracted to small business concerns;

(iii) Total dollars planned to be subcontracted to veteran-owned small business concerns;

(iv) Total dollars planned to be subcontracted to HUBZone small business concerns;

(v) Total dollars planned to be subcontracted to small disadvantaged business concerns; and

(vi) Total dollars planned to be subcontracted to women-owned small business concerns.

(3) A description of the principal types of supplies and services to be subcontracted, and an identification of the types planned for subcontracting to--

(i) Small business concerns;

(ii) Veteran-owned small business concerns;

(iii) HUBZone small business concerns;

(iv) Small disadvantaged business concerns; and

(v) Women-owned small business concerns.

(4) A description of the method used to develop the subcontracting goals in paragraph (d)(1) of this clause.

(5) A description of the method used to identify potential sources for solicitation purposes (e.g., existing company source lists, the Procurement Marketing and Access Network (PRO-Net) of the Small Business Administration (SBA), veterans service organizations, the National Minority Purchasing Council Vendor Information Service, the Research and Information Division of the Minority Business Development Agency in the Department of Commerce, or small, HUBZone, small disadvantaged, and women-owned small business trade associations). A firm may rely on the information contained in PRO-Net as an accurate representation of a concern's size and ownership characteristics for the purposes of maintaining a small, veteran-owned small, HUBZone small, small disadvantaged, and women-owned small business source list. Use of PRO-Net as its source list does not relieve a firm of its responsibilities (e.g., outreach, assistance, counseling, or publicizing subcontracting opportunities) in this clause.

(6) A statement as to whether or not the offeror included indirect costs in establishing subcontracting goals, and a description of the method used to determine the proportionate share of indirect costs to be incurred with—

- (i) Small business concerns;
- (ii) Veteran-owned small business concerns;
- (iii) HUBZone small business concerns;
- (iv) Small disadvantaged business concerns; and
- (v) Women-owned small business concerns.

(7) The name of the individual employed by the offeror who will administer the offeror's subcontracting program, and a description of the duties of the individual.

(8) A description of the efforts the offeror will make to assure that small business, veteran-owned small business, HUBZone small business, small disadvantaged business and women-owned small business concerns have an equitable opportunity to compete for subcontracts.

(9) Assurances that the offeror will include the clause of this contract entitled "Utilization of Small Business Concerns" in all subcontracts that offer further subcontracting opportunities, and that the offeror will require all subcontractors (except small business concerns) that receive subcontracts in excess of \$500,000 (\$1,000,000 for construction of any public facility) to adopt a subcontracting plan that complies with the requirements of this clause.

(10) Assurances that the offeror will--

- (i) Cooperate in any studies or surveys as may be required;
- (ii) Submit periodic reports so that the Government can determine the extent of compliance by the offeror with the subcontracting plan;
- (iii) Submit Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and/or SF 295, Summary Subcontract Report, in accordance with paragraph (j) of this clause. The reports shall provide information on subcontract awards to small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small business concerns, small disadvantaged business concerns, women-owned small business concerns, and Historically Black Colleges and Universities and Minority Institutions. Reporting shall be in accordance with the instructions on the forms or as provided in agency regulations.
- (iv) Ensure that its subcontractors agree to submit SF 294 and SF 295.

(11) A description of the types of records that will be maintained concerning procedures that have been adopted to comply with the requirements and goals in the plan, including establishing source lists; and a description of the

offeror's efforts to locate small business, veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns and award subcontracts to them. The records shall include at least the following (on a plant-wide or company-wide basis, unless otherwise indicated)

(i) Source lists (e.g., PRO-Net), guides, and other data that identify small business, veteran-owner small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns.

(ii) Organizations contacted in an attempt to locate sources that are small business, veteran-owned small business, HUBZone small business, small disadvantaged business, or women-owned small business concerns.

(iii) Records on each subcontract solicitation resulting in an award of more than \$100,000, indicating--

(A) Whether small business concerns were solicited and, if not, why not;

(B) Whether veteran-owned small business concerns were solicited and, if not, why not;

(C) Whether HUBZone small business concerns were solicited and, if not, why not;

(D) Whether small disadvantaged business concerns were solicited and, if not, why not;

(E) Whether women-owned small business concerns were solicited and, if not, why not; and

(F) If applicable, the reason award was not made to a small business concern.

(iv) Records of any outreach efforts to contact--

(A) Trade associations;

(B) Business development organizations;

(C) Conferences and trade fairs to locate small, HUBZone small, small disadvantaged, and women-owned small business sources; and

(D) Veterans service organizations.

(v) Records of internal guidance and encouragement provided to buyers through--

(A) Workshops, seminars, training, etc.; and

(B) Monitoring performance to evaluate compliance with the program's requirements.

(vi) On a contract-by-contract basis, records to support award data submitted by the offeror to the Government, including the name, address, and business size of each subcontractor. Contractors having commercial plans need not comply with this requirement.

(e) In order to effectively implement this plan to the extent consistent with efficient contract performance, the Contractor shall perform the following functions:

(1) Assist small business, veteran-owner small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation by such concerns. Where the Contractor's lists of potential small business, veteran-owner small business, HUBZone small business, small disadvantaged

business, and women-owned small business subcontractors are excessively long, reasonable effort shall be made to give all such small business concerns an opportunity to compete over a period of time.

(2) Provide adequate and timely consideration of the potentialities of small business, veteran-owner small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns in all "make-or-buy" decisions.

(3) Counsel and discuss subcontracting opportunities with representatives of small business, veteran-owner small business, HUBZone small business, small disadvantaged business, and women-owned small business firms.

(4) Provide notice to subcontractors concerning penalties and remedies for misrepresentations of business status as small, veteran-owner small business, HUBZone small, small disadvantaged, or women-owned small business for the purpose of obtaining a subcontract that is to be included as part or all of a goal contained in the Contractor's subcontracting plan.

(f) A master plan on a plant or division-wide basis that contains all the elements required by paragraph (d) of this clause, except goals, may be incorporated by reference as a part of the subcontracting plan required of the offeror by this clause; provided--

(1) the master plan has been approved, (2) the offeror ensures that the master plan is updated as necessary and provides copies of the approved master plan, including evidence of its approval, to the Contracting Officer, and (3) goals and any deviations from the master plan deemed necessary by the Contracting Officer to satisfy the requirements of this contract are set forth in the individual subcontracting plan.

(g) A commercial plan is the preferred type of subcontracting plan for contractors furnishing commercial items. The commercial plan shall relate to the offeror's planned subcontracting generally, for both commercial and Government business, rather than solely to the Government contract. Commercial plans are also preferred for subcontractors that provide commercial items under a prime contract, whether or not the prime contractor is supplying a commercial item.

(h) Prior compliance of the offeror with other such subcontracting plans under previous contracts will be considered by the Contracting Officer in determining the responsibility of the offeror for award of the contract.

(i) The failure of the Contractor or subcontractor to comply in good faith with (1) the clause of this contract entitled "Utilization Of Small Business Concerns," or (2) an approved plan required by this clause, shall be a material breach of the contract.

(j) The Contractor shall submit the following reports:

(1) Standard Form 294, Subcontracting Report for Individual Contracts. This report shall be submitted to the Contracting Officer semiannually and at contract completion. The report covers subcontract award data related to this contract. This report is not required for commercial plans.

(2) Standard Form 295, Summary Subcontract Report. This report encompasses all of the contracts with the awarding agency. It must be submitted semi-annually for contracts with the Department of Defense and annually for contracts with civilian agencies. If the reporting activity is covered by a commercial plan, the reporting activity must report annually all subcontract awards under that plan. All reports submitted at the close of each fiscal year (both individual and commercial plans) shall include a breakout, in the Contractor's format, of subcontract awards, in whole dollars, to small disadvantaged business concerns by North American Industry Classification System (NAICS) Industry Subsector. For a commercial plan, the Contractor may obtain from each of its subcontractors a predominant NAICS Industry Subsector and report all awards to that subcontractor under its predominant NAICS Industry Subsector.

(End of clause)

52.219-16 LIQUIDATED DAMAGES-SUBCONTRACTING PLAN (JAN 1999)

(a) Failure to make a good faith effort to comply with the subcontracting plan, as used in this clause, means a willful or intentional failure to perform in accordance with the requirements of the subcontracting plan approved under the clause in this contract entitled "Small Business Subcontracting Plan," or willful or intentional action to frustrate the plan.

(b) Performance shall be measured by applying the percentage goals to the total actual subcontracting dollars or, if a commercial plan is involved, to the pro rata share of actual subcontracting dollars attributable to Government contracts covered by the commercial plan. If, at contract completion or, in the case of a commercial plan, at the close of the fiscal year for which the plan is applicable, the Contractor has failed to meet its subcontracting goals and the Contracting Officer decides in accordance with paragraph (c) of this clause that the Contractor failed to make a good faith effort to comply with its subcontracting plan, established in accordance with the clause in this contract entitled "Small Business Subcontracting Plan," the Contractor shall pay the Government liquidated damages in an amount stated. The amount of probable damages attributable to the Contractor's failure to comply shall be an amount equal to the actual dollar amount by which the Contractor failed to achieve each subcontract goal.

(c) Before the Contracting Officer makes a final decision that the Contractor has failed to make such good faith effort, the Contracting Officer shall give the Contractor written notice specifying the failure and permitting the Contractor to demonstrate what good faith efforts have been made and to discuss the matter. Failure to respond to the notice may be taken as an admission that no valid explanation exists. If, after consideration of all the pertinent data, the Contracting Officer finds that the Contractor failed to make a good faith effort to comply with the subcontracting plan, the Contracting Officer shall issue a final decision to that effect and require that the Contractor pay the Government liquidated damages as provided in paragraph (b) of this clause.

(d) With respect to commercial plans, the Contracting Officer who approved the plan will perform the functions of the Contracting Officer under this clause on behalf of all agencies with contracts covered by the commercial plan.

(e) The Contractor shall have the right of appeal, under the clause in this contract entitled Disputes, from any final decision of the Contracting Officer.

(f) Liquidated damages shall be in addition to any other remedies that the Government may have.

(End of clause)

52.219-25 SMALL DISADVANTAGED BUSINESS PARTICIPATION PROGRAM—DISADVANTAGED STATUS AND REPORTING (OCT 1999)

(a) Disadvantaged status for joint venture partners, team members, and subcontractors. This clause addresses disadvantaged status for joint venture partners, teaming arrangement members, and subcontractors and is applicable if this contract contains small disadvantaged business (SDB) participation targets. The Contractor shall obtain representations of small disadvantaged status from joint venture partners, teaming arrangement members, and subcontractors through use of a provision substantially the same as paragraph (b)(1)(i) of the provision at FAR 52.219-22, Small Disadvantaged Business Status. The Contractor shall confirm that a joint venture partner, team member, or subcontractor representing itself as a small disadvantaged business concern, is identified as a certified small disadvantaged business in the database maintained by the Small Business Administration (PRO-Net) or by contacting the SBA's Office of Small Disadvantaged Business Certification and Eligibility.

(b) Reporting requirement. If this contract contains SDB participation targets, the Contractor shall report on the participation of SDB concerns at contract completion, or as otherwise provided in this contract. Reporting may be on Optional Form 312, Small Disadvantaged Business Participation Report, or in the Contractor's own format providing

the same information. This report is required for each contract containing SDB participation targets. If this contract contains an individual Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan, reports may be submitted with the final Subcontracting Report for Individual Contracts (Standard Form 294) at the completion of the contract.

(End of clause)

52.222-1 NOTICE TO THE GOVERNMENT OF LABOR DISPUTES (FEB 1997)

If the Contractor has knowledge that any actual or potential labor dispute is delaying or threatens to delay the timely performance of this contract, the Contractor shall immediately give notice, including all relevant information, to the Contracting Officer.

(End of clause)

52.222-3 CONVICT LABOR (JUN 2003)

(a) Except as provided in paragraph (b) of this clause, the Contractor shall not employ in the performance of this contract any person undergoing a sentence of imprisonment imposed by any court of a State, the District of Columbia, Puerto Rico, the Northern Mariana Islands, American Samoa, Guam, or the U.S. Virgin Islands.

(b) The Contractor is not prohibited from employing persons--

(1) On parole or probation to work at paid employment during the term of their sentence;

(2) Who have been pardoned or who have served their terms; or

(3) Confined for violation of the laws of any of the States, the District of Columbia, Puerto Rico, the Northern Mariana Islands, American Samoa, Guam, or the U.S. Virgin Islands who are authorized to work at paid employment in the community under the laws of such jurisdiction, if--

(i) The worker is paid or is in an approved work training program on a voluntary basis;

(ii) Representatives of local union central bodies or similar labor union organizations have been consulted;

(iii) Such paid employment will not result in the displacement of employed workers, or be applied in skills, crafts, or trades in which there is a surplus of available gainful labor in the locality, or impair existing contracts for services;

(iv) The rates of pay and other conditions of employment will not be less than those paid or provided for work of a similar nature in the locality in which the work is being performed; and

(v) The Attorney General of the United States has certified that the work-release laws or **regulations** of the jurisdiction involved are in conformity with the requirements of Executive Order 11755, as amended by Executive Orders 12608 and 12943.

(End of clause)

52.222-4 CONTRACT WORK HOURS AND SAFETY STANDARDS ACT - OVERTIME COMPENSATION. (SEP

2000)

(a) Overtime requirements. No Contractor or subcontractor employing laborers or mechanics (see Federal Acquisition Regulation 22.300) shall require or permit them to work over 40 hours in any workweek unless they are paid at least 1 and 1/2 times the basic rate of pay for each hour worked over 40 hours.

(b) Violation; liability for unpaid wages; liquidated damages. The responsible Contractor and subcontractor are liable for unpaid wages if they violate the terms in paragraph (a) of this clause. In addition, the Contractor and subcontractor are liable for liquidated damages payable to the Government. The Contracting Officer will assess liquidated damages at the rate of \$10 per affected employee for each calendar day on which the employer required or permitted the employee to work in excess of the standard workweek of 40 hours without paying overtime wages required by the Contract Work Hours and Safety Standards Act.

(c) Withholding for unpaid wages and liquidated damages. The Contracting Officer will withhold from payments due under the contract sufficient funds required to satisfy any Contractor or subcontractor liabilities for unpaid wages and liquidated damages. If amounts withheld under the contract are insufficient to satisfy Contractor or subcontractor liabilities, the Contracting Officer will withhold payments from other Federal or Federally assisted contracts held by the same Contractor that are subject to the Contract Work Hours and Safety Standards Act.

(d) Payrolls and basic records.

(1) The Contractor and its subcontractors shall maintain payrolls and basic payroll records for all laborers and mechanics working on the contract during the contract and shall make them available to the Government until 3 years after contract completion. The records shall contain the name and address of each employee, social security number, labor classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. The records need not duplicate those required for construction work by Department of Labor regulations at 29 CFR 5.5(a)(3) implementing the Davis-Bacon Act.

(2) The Contractor and its subcontractors shall allow authorized representatives of the Contracting Officer or the Department of Labor to inspect, copy, or transcribe records maintained under paragraph (d)(1) of this clause. The Contractor or subcontractor also shall allow authorized representatives of the Contracting Officer or Department of Labor to interview employees in the workplace during working hours.

(e) Subcontracts. The Contractor shall insert the provisions set forth in paragraphs (a) through (d) of this clause in subcontracts exceeding \$100,000 and require subcontractors to include these provisions in any lower tier subcontracts. The Contractor shall be responsible for compliance by any subcontractor or lower-tier subcontractor with the provisions set forth in paragraphs (a) through (d) of this clause.

(End of clause)

52.222-6 DAVIS-BACON ACT (FEB 1995)

(a) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (d) of this clause; also, regular

contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such period. Such laborers and mechanics shall be paid not less than the appropriate wage rate and fringe benefits in the wage determination for the classification of work actually performed, without regard to skill, except as provided in the clause entitled Apprentices and Trainees. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein; provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (b) of this clause) and the Davis -Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(b)(1) The Contracting Officer shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The Contracting Officer shall approve an additional classification and wage rate and fringe benefits therefor only when all the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination.

(ii) The classification is utilized in the area by the construction industry.

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the Contracting Officer agree on the classification and wage rate (including the amount designated for fringe benefits, where appropriate), a report of the action taken shall be sent by the Contracting Officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator or an authorized representative will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(3) In the event the Contractor, the laborers or mechanics to be employed in the classification, or their representatives, and the Contracting Officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the Contracting Officer shall refer the questions, including the views of all interested parties and the recommendation of the Contracting Officer, to the Administrator of the Wage and Hour Division for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits, where appropriate) determined pursuant to subparagraphs (b)(2) and (b)(3) of this clause shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(c) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(c) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program; provided, That the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis -Bacon Act have been met. The Secretary of Labor may require

the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(End of clause)

52.222-7 WITHHOLDING OF FUNDS (FEB 1988)

The Contracting Officer shall, upon his or her own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same Prime Contractor, or any other Federally assisted contract subject to Davis -Bacon prevailing wage requirements, which is held by the same Prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(End of clause)

52.222-8 PAYROLLS AND BASIC RECORDS (FEB 1988)

(a) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of 3 years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis -Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. Whenever the Secretary of Labor has found, under paragraph (d) of the clause entitled Davis -Bacon Act, that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis -Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(b)(1) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Contracting Officer. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under paragraph (a) of this clause. This information may be submitted in any form desired. Optional Form WH-347 (Federal Stock Number 029-005-00014-1) is available for this purpose and may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. The Prime Contractor is responsible for the submission of copies of payrolls by all subcontractors.

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify--

(i) That the payroll for the payroll period contains the information required to be maintained under paragraph (a) of

this clause and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR Part 3; and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph (b)(2) of this clause.

(4) The falsification of any of the certifications in this clause may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 3729 of Title 31 of the United States Code.

(c) The Contractor or subcontractor shall make the records required under paragraph (a) of this clause available for inspection, copying, or transcription by the Contracting Officer or authorized representatives of the Contracting Officer or the Department of Labor. The Contractor or subcontractor shall permit the Contracting Officer or representatives of the Contracting Officer or the Department of Labor to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit required records or to make them available, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(End of clause)

52.222-9 APPRENTICES AND TRAINEES (FEB 1988)

(a) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in this paragraph, shall be paid not less than the applicable wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the

applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(b) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed in the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate in the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate in the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate in the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(c) Equal employment opportunity. The utilization of apprentices, trainees, and journeymen under this clause shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

(End of clause)

52.222-10 COMPLIANCE WITH COPELAND ACT REQUIREMENTS (FEB 1988)

The Contractor shall comply with the requirements of 29 CFR Part 3, which are hereby incorporated by reference in this contract.

(End of clause)

52.222-11 SUBCONTRACTS (LABOR STANDARDS (FEB 1988)

(a) The Contractor or subcontractor shall insert in any subcontracts the clauses entitled Davis -Bacon Act, Contract Work Hours and Safety Standards Act-Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Withholding of Funds, Subcontracts (Labor Standards), Contract Termination-Debarment, Disputes Concerning Labor Standards, Compliance with Davis -Bacon and Related Act Regulations, and Certification of Eligibility, and such other clauses as the Contracting Officer may, by appropriate instructions, require, and also a clause requiring subcontractors to include these clauses in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with all the contract clauses cited in this paragraph.

(b)(1) Within 14 days after award of the contract, the Contractor shall deliver to the Contracting Officer a completed Statement and Acknowledgment Form (SF 1413) for each subcontract, including the subcontractor's signed and dated acknowledgment that the clauses set forth in paragraph (a) of this clause have been included in the subcontract.

(2) Within 14 days after the award of any subsequently awarded subcontract the Contractor shall deliver to the Contracting Officer an updated completed SF 1413 for such additional subcontract.

(End of clause)

52.222-12 CONTRACT TERMINATION--DEBARMENT (FEB 1988)

A breach of the contract clauses entitled Davis -Bacon Act, Contract Work Hours and Safety Standards Act--Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Subcontracts (Labor Standards), Compliance with Davis -Bacon and Related Act Regulations, or Certification of Eligibility may be grounds for termination of the contract, and for debarment as a Contractor and subcontractor as provided in 29 CFR 5.12.

(End of clause)

52.222-13 COMPLIANCE WITH DAVIS-BACON AND RELATED ACT REGULATIONS (FEB 1988)

All rulings and interpretations of the Davis -Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are hereby incorporated by reference in this contract.

(End of clause)

52.222-14 DISPUTES CONCERNING LABOR STANDARDS (FEB 1988)

The United States Department of Labor has set forth in 29 CFR Parts 5, 6, and 7 procedures for resolving disputes concerning labor standards requirements. Such disputes shall be resolved in accordance with those procedures and not the Disputes clause of this contract. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(End of clause)

52.222-15 CERTIFICATION OF ELIGIBILITY (FEB 1988)

(a) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis -Bacon Act or 29 CFR 5.12(a)(1).

(b) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis -Bacon Act or 29 CFR 5.12(a)(1).

(d) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(End of clause)

52.222-21 PROHIBITION OF SEGREGATED FACILITIES (FEB 1999)

(a) Segregated facilities, as used in this clause, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees, that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, sex, or national origin because of written or oral policies or employee custom. The term does not include separate or single-user rest rooms or necessary dressing or sleeping areas provided to assure privacy between the sexes.

(b) The Contractor agrees that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this clause is a violation of the Equal Opportunity clause in this contract.

(c) The Contractor shall include this clause in every subcontract and purchase order that is subject to the Equal Opportunity clause of this contract.

(End of clause)

52.222-26 EQUAL OPPORTUNITY (APR 2002)

(a) Definition. United States, as used in this clause, means the 50 States, the District of Columbia, Puerto Rico, the Northern Mariana Islands, American Samoa, Guam, the U.S. Virgin Islands, and Wake Island.

(b) If, during any 12-month period (including the 12 months preceding the award of this contract), the Contractor has been or is awarded nonexempt Federal contracts and/or subcontracts that have an aggregate value in excess of \$10,000, the Contractor shall comply with paragraphs (b)(1) through (b)(11) of this clause, except for work performed outside the United States by employees who were not recruited within the United States. Upon request, the Contractor shall provide information necessary to determine the applicability of this clause.

(1) The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. However, it shall not be a violation of this clause for the Contractor to extend a publicly announced preference in employment to Indians living on or near an Indian reservation, in connection with employment opportunities on or near an Indian reservation, as permitted by 41 CFR 60-1.5.

(2) The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. This shall include, but not be limited to, (i) employment, (ii) upgrading, (iii) demotion, (iv) transfer, (v) recruitment or recruitment advertising, (vi) layoff or termination, (vii) rates of pay or other forms of compensation, and (viii) selection for training, including apprenticeship.

(3) The Contractor shall post in conspicuous places available to employees and applicants for employment the notices to be provided by the Contracting Officer that explain this clause.

(4) The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(5) The Contractor shall send, to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, the notice to be provided by the Contracting Officer advising the labor union or workers' representative of the Contractor's commitments under this clause, and post copies of the notice in conspicuous places available to employees and applicants for employment.

(6) The Contractor shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.

(7) The Contractor shall furnish to the contracting agency all information required by Executive Order 11246, as amended, and by the rules, regulations, and orders of the Secretary of Labor. The Contractor shall also file Standard Form 100 (EEO-1), or any successor form, as prescribed in 41 CFR part 60-1. Unless the Contractor has filed within the 12 months preceding the date of contract award, the Contractor shall, within 30 days after contract award, apply to either the regional Office of Federal Contract Compliance Programs (OFCCP) or the local office of the Equal Employment Opportunity Commission for the necessary forms.

(8) The Contractor shall permit access to its premises, during normal business hours, by the contracting agency or the OFCCP for the purpose of conducting on-site compliance evaluations and complaint investigations. The Contractor shall permit the Government to inspect and copy any books, accounts, records (including computerized records), and other material that may be relevant to the matter under investigation and pertinent to compliance with Executive Order 11246, as amended, and rules and regulations that implement the Executive Order.

(9) If the OFCCP determines that the Contractor is not in compliance with this clause or any rule, regulation, or order of the Secretary of Labor, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts, under the procedures authorized in Executive Order 11246, as amended. In addition, sanctions may be imposed and remedies invoked against the Contractor as provided in Executive Order 11246, as amended; in the rules, regulations, and orders of the Secretary of Labor; or as otherwise provided by law.

(10) The Contractor shall include the terms and conditions of subparagraphs (b)(1) through (11) of this clause in every subcontract or purchase order that is not exempted by the rules, regulations, or orders of the Secretary of Labor issued under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each subcontractor or vendor.

(11) The Contractor shall take such action with respect to any subcontract or purchase order as the contracting officer may direct as a means of enforcing these terms and conditions, including sanctions for noncompliance; provided, that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of any direction, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

(c) Notwithstanding any other clause in this contract, disputes relative to this clause will be governed by the procedures in 41 CFR 60-1.1.

(End of clause)

52.222-27 AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR CONSTRUCTION (FEB 1999)

(a) Definitions. "Covered area," as used in this clause, means the geographical area described in the solicitation for

this contract.

"Deputy Assistant Secretary," as used in this clause, means Deputy Assistant Secretary for Federal Contract Compliance, U.S. Department of Labor, or a designee.

"Employer's identification number," as used in this clause, means the Federal Social Security number used on the employer's quarterly federal tax return, U.S. Treasury Department Form 941.

"Minority," as used in this clause, means--

(1) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

(2) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands);

(3) Black (all persons having origins in any of the black African racial groups not of Hispanic origin); and

(4) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race).

(b) If the Contractor, or a subcontractor at any tier, subcontracts a portion of the work involving any construction trade, each such subcontract in excess of \$10,000 shall include this clause and the Notice containing the goals for minority and female participation stated in the solicitation for this contract.

(c) If the Contractor is participating in a Hometown Plan (41 CFR 60-4) approved by the U.S. Department of Labor in a covered area, either individually or through an association, its affirmative action obligations on all work in the plan area (including goals) shall comply with the plan for those trades that have unions participating in the plan. Contractors must be able to demonstrate participation in, and compliance with, the provisions of the plan. Each Contractor or subcontractor participating in an approved plan is also required to comply with its obligations under the Equal Opportunity clause, and to make a good faith effort to achieve each goal under the plan in each trade in which it has employees. The overall good-faith performance by other Contractors or subcontractors toward a goal in an approved plan does not excuse any Contractor's or subcontractor's failure to make good-faith efforts to achieve the plan's goals.

(d) The Contractor shall implement the affirmative action procedures in subparagraphs (g)(1) through (16) of this clause. The goals stated in the solicitation for this contract are expressed as percentages of the total hours of employment and training of minority and female utilization that the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for the geographical area where that work is actually performed. The Contractor is expected to make substantially uniform progress toward its goals in each craft.

(e) Neither the terms and conditions of any collective bargaining agreement, nor the failure by a union with which the Contractor has a collective bargaining agreement, to refer minorities or women shall excuse the Contractor's obligations under this clause, Executive Order 11246, as amended, or the regulations thereunder.

(f) In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

(g) The Contractor shall take affirmative action to ensure equal employment opportunity. The evaluation of the Contractor's compliance with this clause shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully and implement affirmative action steps at least as extensive as the following:

(1) Ensure a working environment free of harassment, intimidation, and coercion at all sites and in all facilities where the Contractor's employees are assigned to work. The Contractor, if possible, will assign two or more women to each construction project. The Contractor shall ensure that foremen, superintendents, and other onsite supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at these sites or facilities.

(2) Establish and maintain a current list of sources for minority and female recruitment. Provide written notification to minority and female recruitment sources and community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

(3) Establish and maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant, referrals of minorities or females from unions, recruitment sources, or community organizations, and the action taken with respect to each individual. If an individual was sent to the union hiring hall for referral and not referred back to the Contractor by the union or, if referred back, not employed by the Contractor, this shall be documented in the file, along with whatever additional actions the Contractor may have taken.

(4) Immediately notify the Deputy Assistant Secretary when the union or unions with which the Contractor has a collective bargaining agreement has not referred back to the Contractor a minority or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

(5) Develop on-the-job training opportunities and/or participate in training programs for the area that expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under subparagraph (g)(2) of this clause.

(6) Disseminate the Contractor's equal employment policy by--

(i) Providing notice of the policy to unions and to training, recruitment, and outreach programs, and requesting their cooperation in assisting the Contractor in meeting its contract obligations;

(ii) Including the policy in any policy manual and in collective bargaining agreements;

(iii) Publicizing the policy in the company newspaper, annual report, etc.;

(iv) Reviewing the policy with all management personnel and with all minority and female employees at least once a year; and

(v) Posting the policy on bulletin boards accessible to employees at each location where construction work is performed.

(7) Review, at least annually, the Contractor's equal employment policy and affirmative action obligations with all employees having responsibility for hiring, assignment, layoff, termination, or other employment decisions. Conduct review of this policy with all on-site supervisory personnel before initiating construction work at a job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

- (8) Disseminate the Contractor's equal employment policy externally by including it in any advertising in the news media, specifically including minority and female news media. Provide written notification to, and discuss this policy with, other Contractors and subcontractors with which the Contractor does or anticipates doing business.
- (9) Direct recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students, and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than 1 month before the date for acceptance of applications for apprenticeship or training by any recruitment source, send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.
- (10) Encourage present minority and female employees to recruit minority persons and women. Where reasonable, provide after-school, summer, and vacation employment to minority and female youth both on the site and in other areas of the Contractor's workforce.
- (11) Validate all tests and other selection requirements where required under 41 CFR 60-3.
- (12) Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities. Encourage these employees to seek or to prepare for, through appropriate training, etc., opportunities for promotion.
- (13) Ensure that seniority practices, job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment-related activities to ensure that the Contractor's obligations under this contract are being carried out.
- (14) Ensure that all facilities and company activities are nonsegregated except that separate or single-user rest rooms and necessary dressing or sleeping areas shall be provided to assure privacy between the sexes.
- (15) Maintain a record of solicitations for subcontracts for minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.
- (16) Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's equal employment policy and affirmative action obligations.
- (h) The Contractor is encouraged to participate in voluntary associations that may assist in fulfilling one or more of the affirmative action obligations contained in subparagraphs (g)(1) through (16) of this clause. The efforts of a contractor association, joint contractor-union, contractor-community, or similar group of which the contractor is a member and participant may be asserted as fulfilling one or more of its obligations under subparagraphs (g)(1) through (16) of this clause, provided the Contractor--
- (1) Actively participates in the group;
 - (2) Makes every effort to ensure that the group has a positive impact on the employment of minorities and women in the industry;
 - (3) Ensures that concrete benefits of the program are reflected in the Contractor's minority and female workforce participation;
 - (4) Makes a good-faith effort to meet its individual goals and timetables; and
 - (5) Can provide access to documentation that demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply is the Contractor's, and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

(i) A single goal for minorities and a separate single goal for women shall be established. The Contractor is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and nonminority. Consequently, the Contractor may be in violation of Executive Order 11246, as amended, if a particular group is employed in a substantially disparate manner.

(j) The Contractor shall not use goals or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

(k) The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts under Executive Order 11246, as amended.

(l) The Contractor shall carry out such sanctions and penalties for violation of this clause and of the Equal Opportunity clause, including suspension, termination, and cancellation of existing subcontracts, as may be imposed or ordered under Executive Order 11246, as amended, and its implementing regulations, by the OFCCP. Any failure to carry out these sanctions and penalties as ordered shall be a violation of this clause and Executive Order 11246, as amended.

(m) The Contractor in fulfilling its obligations under this clause shall implement affirmative action procedures at least as extensive as those prescribed in paragraph (g) of this clause, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of Executive Order 11246, as amended, the implementing regulations, or this clause, the Deputy Assistant Secretary shall take action as prescribed in 41 CFR 60-4.8.

(n) The Contractor shall designate a responsible official to--

(1) Monitor all employment-related activity to ensure that the Contractor's equal employment policy is being carried out;

(2) Submit reports as may be required by the Government; and

(3) Keep records that shall at least include for each employee the name, address, telephone number, construction trade, union affiliation (if any), employee identification number, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, separate records are not required to be maintained.

Nothing contained herein shall be construed as a limitation upon the application of other laws that establish different standards of compliance or upon the requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

(End of clause)

52.222-35 EQUAL OPPORTUNITY FOR SPECIAL DISABLED VETERANS, VETERANS OF THE VIETNAM ERA, AND OTHER ELIGIBLE VETERANS (DEC 2001)

(a) Definitions. As used in this clause--

All employment openings means all positions except executive and top management, those positions that will be filled from within the Contractor's organization, and positions lasting 3 days or less. This term includes full-time employment, temporary employment of more than 3 days duration, and part-time employment.

Executive and top management means any employee--

(1) Whose primary duty consists of the management of the enterprise in which the individual is employed or of a customarily recognized department or subdivision thereof;

(2) Who customarily and regularly directs the work of two or more other employees;

(3) Who has the authority to hire or fire other employees or whose suggestions and recommendations as to the hiring or firing and as to the advancement and promotion or any other change of status of other employees will be given particular weight;

(4) Who customarily and regularly exercises discretionary powers; and

(5) Who does not devote more than 20 percent or, in the case of an employee of a retail or service establishment, who does not devote more than 40 percent of total hours of work in the work week to activities that are not directly and closely related to the performance of the work described in paragraphs (1) through (4) of this definition. This paragraph (5) does not apply in the case of an employee who is in sole charge of an establishment or a physically separated branch establishment, or who owns at least a 20 percent interest in the enterprise in which the individual is employed.

Other eligible veteran means any other veteran who served on active duty during a war or in a campaign or expedition for which a campaign badge has been authorized.

Positions that will be filled from within the Contractor's organization means employment openings for which the Contractor will give no consideration to persons outside the Contractor's organization (including any affiliates, subsidiaries, and parent companies) and includes any openings the Contractor proposes to fill from regularly established "recall" lists. The exception does not apply to a particular opening once an employer decides to consider applicants outside of its organization.

Qualified special disabled veteran means a special disabled veteran who satisfies the requisite skill, experience, education, and other job-related requirements of the employment position such veteran holds or desires, and who, with or without reasonable accommodation, can perform the essential functions of such position.

Special disabled veteran means--

(1) A veteran who is entitled to compensation (or who but for the receipt of military retired pay would be entitled to compensation) under laws administered by the Department of Veterans Affairs for a disability--

(i) Rated at 30 percent or more; or

(ii) Rated at 10 or 20 percent in the case of a veteran who has been determined under 38 U.S.C. 3106 to have a serious employment handicap (i.e., a significant impairment of the veteran's ability to prepare for, obtain, or retain employment consistent with the veteran's abilities, aptitudes, and interests); or

(2) A person who was discharged or released from active duty because of a service-connected disability.

Veteran of the Vietnam era means a person who--

(1) Served on active duty for a period of more than 180 days and was discharged or released from active duty with other than a dishonorable discharge, if any part of such active duty occurred--

(i) In the Republic of Vietnam between February 28, 1961, and May 7, 1975; or

(ii) Between August 5, 1964, and May 7, 1975, in all other cases; or

(2) Was discharged or released from active duty for a service-connected disability if any part of the active duty was performed--

(i) In the Republic of Vietnam between February 28, 1961, and May 7, 1975; or

(ii) Between August 5, 1964, and May 7, 1975, in all other cases.

(b) General. (1) The Contractor shall not discriminate against the individual because the individual is a special disabled veteran, a veteran of the Vietnam era, or other eligible veteran, regarding any position for which the employee or applicant for employment is qualified. The Contractor shall take affirmative action to employ, advance in employment, and otherwise treat qualified special disabled veterans, veterans of the Vietnam era, and other eligible veterans without discrimination based upon their disability or veterans' status in all employment practices such as--

(i) Recruitment, advertising, and job application procedures;

(ii) Hiring, upgrading, promotion, award of tenure, demotion, transfer, layoff, termination, right of return from layoff and rehiring;

(iii) Rate of pay or any other form of compensation and changes in compensation;

(iv) Job assignments, job classifications, organizational structures, position descriptions, lines of progression, and seniority lists;

(v) Leaves of absence, sick leave, or any other leave;

(vi) Fringe benefits available by virtue of employment, whether or not administered by the Contractor;

(vii) Selection and financial support for training, including apprenticeship, and on-the-job training under 38 U.S.C. 3687, professional meetings, conferences, and other related activities, and selection for leaves of absence to pursue training;

(viii) Activities sponsored by the Contractor including social or recreational programs; and

(ix) Any other term, condition, or privilege of employment.

(2) The Contractor shall comply with the rules, regulations, and relevant orders of the Secretary of Labor issued under the Vietnam Era Veterans' Readjustment Assistance Act of 1972 (the Act), as amended (38 U.S.C. 4211 and 4212).

(c) Listing openings. (1) The Contractor shall immediately list all employment openings that exist at the time of the execution of this contract and those which occur during the performance of this contract, including those not generated by this contract, and including those occurring at an establishment of the Contractor other than the one where the contract is being performed, but excluding those of independently operated corporate affiliates, at an appropriate local public employment service office of the State wherein the opening occurs. Listing employment openings with the U.S. Department of Labor's America's Job Bank shall satisfy the requirement to list jobs with the local employment service office.

(2) The Contractor shall make the listing of employment openings with the local employment service office at least concurrently with using any other recruitment source or effort and shall involve the normal obligations of placing a bona fide job order, including accepting referrals of veterans and nonveterans. This listing of employment openings does not require hiring any particular job applicant or hiring from any particular group of job applicants and is not intended to relieve the Contractor from any requirements of Executive orders or regulations concerning nondiscrimination in employment.

(3) Whenever the Contractor becomes contractually bound to the listing terms of this clause, it shall advise the State public employment agency in each State where it has establishments of the name and location of each hiring location in the State. As long as the Contractor is contractually bound to these terms and has so advised the State agency, it need not advise the State agency of subsequent contracts. The Contractor may advise the State agency when it is no longer bound by this contract clause.

(d) Applicability. This clause does not apply to the listing of employment openings that occur and are filled outside the 50 States, the District of Columbia, the Commonwealth of Puerto Rico, the Commonwealth of the Northern Mariana Islands, American Samoa, Guam, the Virgin Islands of the United States, and Wake Island.

(e) Postings. (1) The Contractor shall post employment notices in conspicuous places that are available to employees and applicants for employment.

(2) The employment notices shall--

(i) State the rights of applicants and employees as well as the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified employees and applicants who are special disabled veterans, veterans of the Vietnam era, and other eligible veterans; and

(ii) Be in a form prescribed by the Deputy Assistant Secretary for Federal Contract Compliance Programs, Department of Labor (Deputy Assistant Secretary of Labor), and provided by or through the Contracting Officer.

(3) The Contractor shall ensure that applicants or employees who are special disabled veterans are informed of the contents of the notice (e.g., the Contractor may have the notice read to a visually disabled veteran, or may lower the posted notice so that it can be read by a person in a wheelchair).

(4) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement, or other contract understanding, that the Contractor is bound by the terms of the Act and is committed to take affirmative action to employ, and advance in employment, qualified special disabled veterans, veterans of the Vietnam era, and other eligible veterans.

(f) Noncompliance. If the Contractor does not comply with the requirements of this clause, the Government may take appropriate actions under the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

(g) Subcontracts. The Contractor shall insert the terms of this clause in all subcontracts or purchase orders of \$25,000 or more unless exempted by rules, regulations, or orders of the Secretary of Labor. The Contractor shall act as specified by the Deputy Assistant Secretary of Labor to enforce the terms, including action for noncompliance.

(End of clause)

(a) General. (1) Regarding any position for which the employee or applicant for employment is qualified, the Contractor shall not discriminate against any employee or applicant because of physical or mental disability. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified individuals with disabilities without discrimination based upon their physical or mental disability in all employment practices such as--

- (i) Recruitment, advertising, and job application procedures;
- (ii) Hiring, upgrading, promotion, award of tenure, demotion, transfer, layoff, termination, right of return from layoff, and rehiring;
- (iii) Rates of pay or any other form of compensation and changes in compensation;
- (iv) Job assignments, job classifications, organizational structures, position descriptions, lines of progression, and seniority lists;
- (v) Leaves of absence, sick leave, or any other leave;
- (vi) Fringe benefits available by virtue of employment, whether or not administered by the Contractor;
- (vii) Selection and financial support for training, including apprenticeships, professional meetings, conferences, and other related activities, and selection for leaves of absence to pursue training;
- (viii) Activities sponsored by the Contractor, including social or recreational programs; and
- (ix) Any other term, condition, or privilege of employment.

(2) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor (Secretary) issued under the Rehabilitation Act of 1973 (29 U.S.C. 793) (the Act), as amended.

(b) Postings. (1) The Contractor agrees to post employment notices stating--

- (i) The Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified individuals with disabilities; and
- (ii) The rights of applicants and employees.

(2) These notices shall be posted in conspicuous places that are available to employees and applicants for employment. The Contractor shall ensure that applicants and employees with disabilities are informed of the contents of the notice (e.g., the Contractor may have the notice read to a visually disabled individual, or may lower the posted notice so that it might be read by a person in a wheelchair). The notices shall be in a form prescribed by the Deputy Assistant Secretary for Federal Contract Compliance of the U.S. Department of Labor (Deputy Assistant Secretary) and shall be provided by or through the Contracting Officer.

(3) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of Section 503 of the Act and is committed to take affirmative action to employ, and advance in employment, qualified individuals with physical or mental disabilities.

(c) Noncompliance. If the Contractor does not comply with the requirements of this clause, appropriate actions may be taken under the rules, regulations, and relevant orders of the Secretary issued pursuant to the Act.

(d) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order in excess of \$10,000 unless exempted by rules, regulations, or orders of the Secretary. The Contractor shall act as specified by the Deputy Assistant Secretary to enforce the terms, including action for noncompliance.

(End of clause)

52.222-37 EMPLOYMENT REPORTS ON SPECIAL DISABLED VETERANS, VETERANS OF THE VIETNAM ERA, AND OTHER ELIGIBLE VETERANS (DEC 2001)

(a) Unless the Contractor is a State or local government agency, the Contractor shall report at least annually, as required by the Secretary of Labor, on--

(1) The number of disabled veterans and the number of veterans of the Vietnam era in the workforce of the contractor by job category and hiring location; and

(2) The total number of new employees hired during the period covered by the report, and of that total, the number of disabled veterans, and the number of veterans of the Vietnam era.

(b) The above items shall be reported by completing the form entitled "Federal Contractor Veterans' Employment Report VETS-100."

(c) Reports shall be submitted no later than September 30 of each year beginning September 30, 1988.

(d) The employment activity report required by paragraph (a)(2) of this clause shall reflect total hires during the most recent 12-month period as of the ending date selected for the employment profile report required by paragraph (a)(1) of this clause. Contractors may select an ending date: (1) As of the end of any pay period during the period January through March 1st of the year the report is due, or (2) as of December 31, if the contractor has previous written approval from the Equal Employment Opportunity Commission to do so for purposes of submitting the Employer Information Report EEO-1 (Standard Form 100).

(e) The count of veterans reported according to paragraph (a) of this clause shall be based on voluntary disclosure. Each Contractor subject to the reporting requirements at 38 U.S.C. 4212 shall invite all disabled veterans and veterans of the Vietnam era who wish to benefit under the affirmative action program at 38 U.S.C. 4212 to identify themselves to the Contractor. The invitation shall state that the information is voluntarily provided; that the information will be kept confidential; that disclosure or refusal to provide the information will not subject the applicant or employee to any adverse treatment; and that the information will be used only in accordance with the regulations promulgated under 38 U.S.C. 4212.

(f) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order of \$10,000 or more unless exempted by rules, regulations, or orders of the Secretary.

(End of clause)

52.223-3 HAZARDOUS MATERIAL IDENTIFICATION AND MATERIAL SAFETY DATA (JAN 1997)

(a) "Hazardous material", as used in this clause, includes any material defined as hazardous under the latest version of Federal Standard No. 313 (including revisions adopted during the term of the contract).

(b) The offeror must list any hazardous material, as defined in paragraph (a) of this clause, to be delivered under this contract. The hazardous material shall be properly identified and include any applicable identification number, such

as National Stock Number or Special Item Number. This information shall also be included on the Material Safety Data Sheet submitted under this contract.

Material	Identification No.
(If none, insert "None")	

(c) This list must be updated during performance of the contract whenever the Contractor determines that any other material to be delivered under this contract is hazardous.

(d) The apparently successful offeror agrees to submit, for each item as required prior to award, a Material Safety Data Sheet, meeting the requirements of 29 CFR 1910.1200(g) and the latest version of Federal Standard No. 313, for all hazardous material identified in paragraph (b) of this clause. Data shall be submitted in accordance with Federal Standard No. 313, whether or not the apparently successful offeror is the actual manufacturer of these items. Failure to submit the Material Safety Data Sheet prior to award may result in the apparently successful offeror being considered nonresponsible and ineligible for award.

(e) If, after award, there is a change in the composition of the item(s) or a revision to Federal Standard No. 313, which renders incomplete or inaccurate the data submitted under paragraph (d) of this clause, the Contractor shall promptly notify the Contracting Officer and resubmit the data.

(f) Neither the requirements of this clause nor any act or failure to act by the Government shall relieve the Contractor of any responsibility or liability for the safety of Government, Contractor, or subcontractor personnel or property.

(g) Nothing contained in this clause shall relieve the Contractor from complying with applicable Federal, State, and local laws, codes, ordinances, and regulations (including the obtaining of licenses and permits) in connection with hazardous material.

(h) The Government's rights in data furnished under this contract with respect to hazardous material are as follows:

(1) To use, duplicate and disclose any data to which this clause is applicable. The purposes of this right are to--

(i) Apprise personnel of the hazards to which they may be exposed in using, handling, packaging, transporting, or disposing of hazardous materials;

(ii) Obtain medical treatment for those affected by the material; and

(iii) Have others use, duplicate, and disclose the data for the Government for these purposes.

(2) To use, duplicate, and disclose data furnished under this clause, in accordance with subparagraph (h)(1) of this clause, in precedence over any other clause of this contract providing for rights in data.

(3) The Government is not precluded from using similar or identical data acquired from other sources.

(End of clause)

52.223-5 POLLUTION PREVENTION AND RIGHT-TO-KNOW INFORMATION (AUG 2003)

(a) Definitions. As used in this clause--

Priority chemical means a chemical identified by the Interagency Environmental Leadership Workgroup or, alternatively, by an agency pursuant to section 503 of Executive Order 13148 of April 21, 2000, Greening the Government through Leadership in Environmental Management.

“Toxic chemical means a chemical or chemical category listed in 40 CFR 372.65.”

(b) Executive Order 13148 requires Federal facilities to comply with the provisions of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11001-11050) and the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13101-13109).

(c) The Contractor shall provide all information needed by the Federal facility to comply with the following:

- (1) The emergency planning reporting requirements of section 302 of EPCRA.
- (2) The emergency notice requirements of section 304 of EPCRA.
- (3) The list of Material Safety Data Sheets, required by section 311 of EPCRA.
- (4) The emergency and hazardous chemical inventory forms of section 312 of EPCRA.
- (5) The toxic chemical release inventory of section 313 of EPCRA, which includes the reduction and recycling information required by section 6607 of PPA.
- (6) The toxic chemical, priority chemical, and hazardous substance release and use reduction goals of sections 502 and 503 of Executive Order 13148.

(End of clause)

52.223-9 ESTIMATE OF PERCENTAGE OF RECOVERED MATERIAL CONTENT FOR EPA-DESIGNATED PRODUCTS (AUG 2000)

(a) Definitions. As used in this clause--

Postconsumer material means a material or finished product that has served its intended use and has been discarded for disposal or recovery, having completed its life as a consumer item. Postconsumer material is a part of the broader category of “recovered material.”

Recovered material means waste materials and by-products recovered or diverted from solid waste, but the term does not include those materials and by-products generated from, and commonly reused within, an original manufacturing process.

(b) The Contractor, on completion of this contract, shall--

- (1) Estimate the percentage of the total recovered material used in contract performance, including, if applicable, the percentage of postconsumer material content; and

(2) Submit this estimate to **Susan K. Sherrell, Contracting Office, U.S. Army Corps of Engineers, Seattle District.**

(End of clause)

52.223-14 TOXIC CHEMICAL RELEASE REPORTING (AUG 2003)

(a) Unless otherwise exempt, the Contractor, as owner or operator of a facility used in the performance of this contract, shall file by July 1 for the prior calendar year an annual Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023(a) and (g)), and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106). The Contractor shall file, for each facility subject to the Form R filing and reporting requirements, the annual Form R throughout the life of the contract.

(b) A Contractor-owned or -operated facility used in the performance of this contract is exempt from the requirement to file an annual Form R if--

- (1) The facility does not manufacture, process, or otherwise use any toxic chemicals listed in 40 CFR 372.65;
 - (2) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023(b)(1)(A);
 - (3) The facility does not meet the reporting thresholds of toxic chemicals established under of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);
 - (4) The facility does not fall within the following Standard Industrial Classification (SIC) codes or their corresponding North American Industry Classification System sectors:
 - (i) Major group code 10 (except 1011, 1081, and 1094.
 - (ii) Major group code 12 (except 1241).
 - (iii) Major group codes 20 through 39.
 - (iv) Industry code 4911, 4931, or 4939 (limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce).
 - (v) Industry code 4953 (limited to facilities regulated under the Resource Conservation and Recovery Act, Subtitle C (42 U.S.C. 6921, et seq.)), 5169, 5171, or 7389 (limited to facilities primarily engaged in solvent recovery services on a contract or fee basis); or
 - (5) The facility is not located in the United States or its outlying areas.
- (c) If the Contractor has certified to an exemption in accordance with one or more of the criteria in paragraph (b) of this clause, and after award of the contract circumstances change so that any of its owned or operated facilities used in the performance of this contract is no longer exempt--

(1) The Contractor shall notify the Contracting Officer; and

(2) The Contractor, as owner or operator of a facility used in the performance of this contract that is no longer exempt, shall (i) submit a Toxic Chemical Release Inventory Form (Form R) on or before July 1 for the prior calendar year

during which the facility becomes eligible; and (ii) continue to file the annual Form R for the life of the contract for such facility.

(d) The Contracting Officer may terminate this contract or take other action as appropriate, if the Contractor fails to comply accurately and fully with the EPCRA and PPA toxic chemical release filing and reporting requirements.

(e) Except for acquisitions of commercial items, as defined in FAR Part 2, the Contractor shall--

(1) For competitive subcontracts expected to exceed \$100,000 (including all options), include a solicitation provision substantially the same as the provision at FAR 52.223-13, Certification of Toxic Chemical Release Reporting; and

(2) Include in any resultant subcontract exceeding \$100,000 (including all options), the substance of this clause, except this paragraph (e).

(End of clause)

52.225-9 BUY AMERICAN ACT—CONSTRUCTION MATERIALS (JAN 2005)

(a) Definitions. As used in this clause--

Component means an article, material, or supply incorporated directly into a construction material.

Construction material means an article, material, or supply brought to the construction site by the Contractor or a subcontractor for incorporation into the building or work. The term also includes an item brought to the site preassembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, that are discrete systems incorporated into a public building or work and that are produced as complete systems, are evaluated as a single and distinct construction material regardless of when or how the individual parts or components of those systems are delivered to the construction site. Materials purchased directly by the Government are supplies, not construction material.

Cost of components means--

(1) For components purchased by the Contractor, the acquisition cost, including transportation costs to the place of incorporation into the construction material (whether or not such costs are paid to a domestic firm), and any applicable duty (whether or not a duty-free entry certificate is issued); or

(2) For components manufactured by the Contractor, all costs associated with the manufacture of the component, including transportation costs as described in paragraph (1) of this definition, plus allocable overhead costs, but excluding profit. Cost of components does not include any costs associated with the manufacture of the construction material.

Domestic construction material means--

(1) An unmanufactured construction material mined or produced in the United States; or

(2) A construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind for which nonavailability determinations have been made are treated as domestic.

Foreign construction material means a construction material other than a domestic construction material.

United States means the 50 States, the District of Columbia, and outlying areas.

(b) Domestic preference. (1) This clause implements the Buy American Act (41 U.S.C. 10a-10d) by providing a preference for domestic construction material. The Contractor shall use only domestic construction material in performing this contract, except as provided in paragraphs (b)(2) and (b)(3) of this clause.

(2) This requirement does not apply to the construction material or components listed by the Government as follows:
None.

(3) The Contracting Officer may add other foreign construction material to the list in paragraph (b)(2) of this clause if the Government determines that

(i) The cost of domestic construction material would be unreasonable. The cost of a particular domestic construction material subject to the requirements of the Buy American Act is unreasonable when the cost of such material exceeds the cost of foreign material by more than 6 percent;

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(c) Request for determination of inapplicability of the Buy American Act. (1)(i) Any Contractor request to use foreign construction material in accordance with paragraph (b)(3) of this clause shall include adequate information for Government evaluation of the request, including--

(A) A description of the foreign and domestic construction materials;

(B) Unit of measure;

(C) Quantity;

(D) Price;

(E) Time of delivery or availability;

(F) Location of the construction project;

(G) Name and address of the proposed supplier; and

(H) A detailed justification of the reason for use of foreign construction materials cited in accordance with paragraph (b)(3) of this clause.

(ii) A request based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause.

(iii) The price of construction material shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(iv) Any Contractor request for a determination submitted after contract award shall explain why the Contractor could not reasonably foresee the need for such determination and could not have requested the determination before contract award. If the Contractor does not submit a satisfactory explanation, the Contracting Officer need not make a determination.

(2) If the Government determines after contract award that an exception to the Buy American Act applies and the Contracting Officer and the Contractor negotiate adequate consideration, the Contracting Officer will modify the contract to allow use of the foreign construction material. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration is not less than the differential established in paragraph (b)(3)(i) of this clause.

(3) Unless the Government determines that an exception to the Buy American Act applies, use of foreign construction material is noncompliant with the Buy American Act.

(d) Data. To permit evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the Contractor shall include the following information and any applicable supporting data based on the survey of suppliers:

Foreign and Domestic Construction Materials Price Comparison

Construction material description	Unit of measure	Quantity	Price (dollars) \1\
Item 1			
Foreign construction material....			
Domestic construction material....			
Item 2			
Foreign construction material....			
Domestic construction material....			

Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free entry certificate is issued).

List name, address, telephone number, and contact for suppliers surveyed. Attach copy of response; if oral, attach summary.

Include other applicable supporting information.

(End of clause)

52.225-10 NOTICE OF BUY AMERICAN ACT REQUIREMENT--CONSTRUCTION MATERIALS (MAY 2002)

(a) Definitions. Construction material, domestic construction material, and foreign construction material, as used in this provision, are defined in the clause of this solicitation entitled "Buy American Act --Construction Materials" (Federal Acquisition Regulation (FAR) clause 52.225-9).

(b) Requests for determinations of inapplicability. An offeror requesting a determination regarding the inapplicability of the Buy American Act should submit the request to the Contracting Officer in time to allow a determination before submission of offers. The offeror shall include the information and applicable supporting data required by paragraphs (c) and (d) of the clause at FAR 52.225-9 in the request. If an offeror has not requested a determination regarding the inapplicability of the Buy American Act before submitting its offer, or has not received a response to a previous request, the offeror shall include the information and supporting data in the offer.

(c) Evaluation of offers. (1) The Government will evaluate an offer requesting exception to the requirements of the Buy American Act, based on claimed unreasonable cost of domestic construction material, by adding to the offered price the appropriate percentage of the cost of such foreign construction material, as specified in paragraph (b)(3)(i) of the clause at FAR 52.225-9.

(2) If evaluation results in a tie between an offeror that requested the substitution of foreign construction material based on unreasonable cost and an offeror that did not request an exception, the Contracting Officer will award to the offeror that did not request an exception based on unreasonable cost.

(d) Alternate offers.

(1) When an offer includes foreign construction material not listed by the Government in this solicitation in paragraph (b)(2) of the clause at FAR 52.225-9, the offeror also may submit an alternate offer based on use of equivalent domestic construction material.

(2) If an alternate offer is submitted, the offeror shall submit a separate Standard Form 1442 for the alternate offer, and a separate price comparison table prepared in accordance with paragraphs (c) and (d) of the clause at FAR 52.225-9 for the offer that is based on the use of any foreign construction material for which the Government has not yet determined an exception applies.

(3) If the Government determines that a particular exception requested in accordance with paragraph (c) of the clause at FAR 52.225-9 does not apply, the Government will evaluate only those offers based on use of the equivalent domestic construction material, and the offeror shall be required to furnish such domestic construction material. An offer based on use of the foreign construction material for which an exception was requested--

(i) Will be rejected as nonresponsive if this acquisition is conducted by sealed bidding; or

(ii) May be accepted if revised during negotiations.

(End of provision)

52.225-13 RESTRICTIONS ON CERTAIN FOREIGN PURCHASES (DEC 2003)

(a) Except as authorized by the Office of Foreign Assets Control (OFAC) in the Department of the Treasury, the Contractor shall not acquire, for use in the performance of this contract, any supplies or services if any proclamation, Executive order, or statute administered by OFAC, or if OFAC's implementing regulations at 31 CFR chapter V, would prohibit such a transaction by a person subject to the jurisdiction of the United States.

(b) Except as authorized by OFAC, most transactions involving Cuba, Iran, Libya, and Sudan are prohibited, as are most imports from North Korea, into the United States or its outlying areas. Lists of entities and individuals subject to economic sanctions are included in OFAC's List of Specially Designated Nationals and Blocked Persons at TerList1.html. More information about these restrictions, as well as updates, is available in the OFAC's regulations at 31 CFR chapter V and/or on OFAC's Web site at <http://www.treas.gov/ofac>.

(c) The Contractor shall insert this clause, including this paragraph (c), in all subcontracts.

(End of clause)

52.227-1 AUTHORIZATION AND CONSENT (JUL 1995)

(a) The Government authorizes and consents to all use and manufacture, in performing this contract or any

subcontract at any tier, of any invention described in and covered by a United States patent (1) embodied in the structure or composition of any article the delivery of which is accepted by the Government under this contract or (2) used in machinery, tools, or methods whose use necessarily results from compliance by the Contractor or a subcontractor with (i) specifications or written provisions forming a part of this contract or (ii) specific written instructions given by the Contracting Officer directing the manner of performance. The entire liability to the Government for infringement of a patent of the United States shall be determined solely by the provisions of the indemnity clause, if any, included in this contract or any subcontract hereunder (including any lower-tier subcontract), and the Government assumes liability for all other infringement to the extent of the authorization and consent hereinabove granted.

(b) The Contractor agrees to include, and require inclusion of, this clause, suitably modified to identify the parties, in all subcontracts at any tier for supplies or services (including construction, architect-engineer services, and materials, supplies, models, samples, and design or testing services expected to exceed the simplified acquisition threshold (however, omission of this clause from any subcontract, including those at or below the simplified acquisition threshold, does not affect this authorization and consent.)

(End of clause)

52.227-2 NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHT INFRINGEMENT (AUG 1996)

(a) The Contractor shall report to the Contracting Officer, promptly and in reasonable written detail, each notice or claim of patent or copyright infringement based on the performance of this contract of which the Contractor has knowledge.

(b) In the event of any claim or suit against the Government on account of any alleged patent or copyright infringement arising out of the performance of this contract or out of the use of any supplies furnished or work or services performed under this contract, the Contractor shall furnish to the Government, when requested by the Contracting Officer, all evidence and information in possession of the Contractor pertaining to such suit or claim. Such evidence and information shall be furnished at the expense of the Government except where the Contractor has agreed to indemnify the Government.

(e) The Contractor agrees to include, and require inclusion of, this clause in all subcontracts at any tier for supplies or services (including construction and architect-engineer subcontracts and those for material, supplies, models, samples, or design or testing services) expected to exceed the simplified acquisition threshold at (FAR) 2.101 to exceed the dollar amount set forth in 13.000 of the Federal Acquisition Regulation (FAR).

(End of clause)

52.227-4 PATENT INDEMNITY--CONSTRUCTION CONTRACTS (APR 1984)

Except as otherwise provided, the Contractor agrees to indemnify the Government and its officers, agents, and employees against liability, including costs and expenses, for infringement upon any United States patent (except a patent issued upon an application that is now or may hereafter be withheld from issue pursuant to a Secrecy Order under 35 U.S.C. 181) arising out of performing this contract or out of the use or disposal by or for the account of the Government of supplies furnished or work performed under this contract.

(End of clause)

52.228-2 ADDITIONAL BOND SECURITY (OCT 1997)

The Contractor shall promptly furnish additional security required to protect the Government and persons supplying labor or materials under this contract if--

- (a) Any surety upon any bond, or issuing financial institution for other security, furnished with this contract becomes unacceptable to the Government.
- (b) Any surety fails to furnish reports on its financial condition as required by the Government;
- (c) The contract price is increased so that the penal sum of any bond becomes inadequate in the opinion of the Contracting Officer; or
- (d) An irrevocable letter of credit (ILC) used as security will expire before the end of the period of required security. If the Contractor does not furnish an acceptable extension or replacement ILC, or other acceptable substitute, at least 30 days before an ILC's scheduled expiration, the Contracting officer has the right to immediately draw on the ILC.

(End of clause)

52.228-11 PLEDGES OF ASSETS (FEB 1992)

(a) Offerors shall obtain from each person acting as an individual surety on a bid guarantee, a performance bond, or a payment bond--

(1) Pledge of assets; and

(2) Standard Form 28, Affidavit of Individual Surety.

(b) Pledges of assets from each person acting as an individual surety shall be in the form of--

(1) Evidence of an escrow account containing cash, certificates of deposit, commercial or Government securities, or other assets described in FAR 28.203-2 (except see 28.203-2(b)(2) with respect to Government securities held in book entry form) and/or;

(2) A recorded lien on real estate. The offeror will be required to provide--

(i) Evidence of title in the form of a certificate of title prepared by a title insurance company approved by the United States Department of Justice. This title evidence must show fee simple title vested in the surety along with any concurrent owners; whether any real estate taxes are due and payable; and any recorded encumbrances against the property, including the lien filed in favor of the Government as required by FAR 28.203-3(d);

(ii) Evidence of the amount due under any encumbrance shown in the evidence of title;

(iii) A copy of the current real estate tax assessment of the property or a current appraisal dated no earlier than 6 months prior to the date of the bond, prepared by a professional appraiser who certifies that the appraisal has been conducted in accordance with the generally accepted appraisal standards as reflected in the Uniform Standards of Professional Appraisal Practice, as promulgated by the Appraisal Foundation.

(End of clause)

52.228-12 PROSPECTIVE SUBCONTRACTOR REQUESTS FOR BONDS. (OCT 1995)

In accordance with Section 806(a)(3) of Pub. L. 102-190, as amended by Sections 2091 and 8105 of Pub. L. 103-355, upon the request of a prospective subcontractor or supplier offering to furnish labor or material for the performance of this contract for which a payment bond has been furnished to the Government pursuant to the Miller Act, the Contractor shall promptly provide a copy of such payment bond to the requester.

(End of clause)

52.228-14 IRREVOCABLE LETTER OF CREDIT (DEC 1999)

(a) "Irrevocable letter of credit" (ILC), as used in this clause, means a written commitment by a federally insured financial institution to pay all or part of a stated amount of money, until the expiration date of the letter, upon presentation by the Government (the beneficiary) of a written demand therefor. Neither the financial institution nor the offeror/Contractor can revoke or condition the letter of credit.

(b) If the offeror intends to use an ILC in lieu of a bid bond, or to secure other types of bonds such as performance and payment bonds, the letter of credit and letter of confirmation formats in paragraphs (e) and (f) of this clause shall be used.

(c) The letter of credit shall be irrevocable, shall require presentation of no document other than a written demand and the ILC (including confirming letter, if any), shall be issued/confirmed by an acceptable federally insured financial institution as provided in paragraph (d) of this clause, and--

(1) If used as a bid guarantee, the ILC shall expire no earlier than 60 days after the close of the bid acceptance period;

(2) If used as an alternative to corporate or individual sureties as security for a performance or payment bond, the offeror/Contractor may submit an ILC with an initial expiration date estimated to cover the entire period for which financial security is required or may submit an ILC with an initial expiration date that is a minimum period of one year from the date of issuance. The ILC shall provide that, unless the issuer provides the beneficiary written notice of non-renewal at least 60 days in advance of the current expiration date, the ILC is automatically extended without amendment for one year from the expiration date, or any future expiration date, until the period of required coverage is completed and the Contracting Officer provides the financial institution with a written statement waiving the right to payment. The period of required coverage shall be:

(i) For contracts subject to the Miller Act, the later of--

(A) One year following the expected date of final payment;

(B) For performance bonds only, until completion of any warranty period; or

(C) For payment bonds only, until resolution of all claims filed against the payment bond during the one-year period following final payment.

(ii) For contracts not subject to the Miller Act, the later of--

(A) 90 days following final payment; or

(B) For performance bonds only, until completion of any warranty period.

(d) Only federally insured financial institutions rated investment grade or higher shall issue or confirm the ILC. The offeror/Contractor shall provide the Contracting Officer a credit rating that indicates the financial institution has the required rating(s) as of the date of issuance of the ILC. Unless the financial institution issuing the ILC had letter of credit business of less than \$25 million in the past year, ILCs over \$5 million must be confirmed by another acceptable financial institution that had letter of credit business of less than \$25 million in the past year.

(e) The following format shall be used by the issuing financial institution to create an ILC:

[Issuing Financial Institution's Letterhead or Name and Address]

Issue Date _____

IRREVOCABLE LETTER OF CREDIT NO. _____

Account party's name _____

Account party's address _____

For Solicitation No. _____ (for reference only)

TO: [U.S. Government agency]

[U.S. Government agency's address]

1. We hereby establish this irrevocable and transferable Letter of Credit in your favor for one or more drawings up to United States \$_____. This Letter of Credit is payable at [issuing financial institution's and, if any, confirming financial institution's] office at [issuing financial institution's address and, if any, confirming financial institution's address] and expires with our close of business on _____, or any automatically extended expiration date.

2. We hereby undertake to honor your or the transferee's sight draft(s) drawn on the issuing or, if any, the confirming financial institution, for all or any part of this credit if presented with this Letter of Credit and confirmation, if any, at the office specified in paragraph 1 of this Letter of Credit on or before the expiration date or any automatically extended expiration date.

3. [This paragraph is omitted if used as a bid guarantee, and subsequent paragraphs are renumbered.] It is a condition of this Letter of Credit that it is deemed to be automatically extended without amendment for one year from the expiration date hereof, or any future expiration date, unless at least 60 days prior to any expiration date, we notify you or the transferee by registered mail, or other receipted means of delivery, that we elect not to consider this Letter of Credit renewed for any such additional period. At the time we notify you, we also agree to notify the account party (and confirming financial institution, if any) by the same means of delivery.

4. This Letter of Credit is transferable. Transfers and assignments of proceeds are to be effected without charge to either the beneficiary or the transferee/assignee of proceeds. Such transfer or assignment shall be only at the written direction of the Government (the beneficiary) in a form satisfactory to the issuing financial institution and the confirming financial institution, if any.

5. This Letter of Credit is subject to the Uniform Customs and Practice (UCP) for Documentary Credits, 1993 Revision, International Chamber of Commerce Publication No. 500, and to the extent not inconsistent therewith, to the laws of _____ [state of confirming financial institution, if any, otherwise state of issuing financial institution].

6. If this credit expires during an interruption of business of this financial institution as described in Article 17 of the UCP, the financial institution specifically agrees to effect payment if this credit is drawn against within 30 days after the resumption of our business.

Sincerely,

[Issuing financial institution]

(f) The following format shall be used by the financial institution to confirm an ILC:

[Confirming Financial Institution's Letterhead or Name and Address]

(Date) _____

Our Letter of Credit Advice Number _____

Beneficiary: _____ [U.S. Government agency]

Issuing Financial Institution: _____

Issuing Financial Institution's LC No.: _____

Gentlemen:

1. We hereby confirm the above indicated Letter of Credit, the original of which is attached, issued by _____ [name of issuing financial institution] for drawings of up to United States dollars _____/U.S. \$_____ and expiring with our close of business on _____ [the expiration date], or any automatically extended expiration date.

2. Draft(s) drawn under the Letter of Credit and this Confirmation are payable at our office located at _____.

3. We hereby undertake to honor sight draft(s) drawn under and presented with the Letter of Credit and this Confirmation at our offices as specified herein.

4. [This paragraph is omitted if used as a bid guarantee, and subsequent paragraphs are renumbered.] It is a condition of this confirmation that it be deemed automatically extended without amendment for one year from the expiration date hereof, or any automatically extended expiration date, unless:

(a) At least 60 days prior to any such expiration date, we shall notify the Contracting Officer, or the transferee and the issuing financial institution, by registered mail or other receipted means of delivery, that we elect not to consider this confirmation extended for any such additional period; or

(b) The issuing financial institution shall have exercised its right to notify you or the transferee, the account party, and ourselves, of its election not to extend the expiration date of the Letter of Credit.

5. This confirmation is subject to the Uniform Customs and Practice (UCP) for Documentary Credits, 1993 Revision, International Chamber of Commerce Publication No. 500, and to the extent not inconsistent therewith, to the laws of _____ [state of confirming financial institution].

6. If this confirmation expires during an interruption of business of this financial institution as described in Article 17 of the UCP, we specifically agree to effect payment if this credit is drawn against within 30 days after the resumption of our business.

Sincerely,

[Confirming financial institution]

(g) The following format shall be used by the Contracting Officer for a sight draft to draw on the Letter of Credit:

SIGHT DRAFT

[City, State]

(Date) _____

[Name and address of financial institution]

Pay to the order of _____ [Beneficiary Agency] _____ the sum of United States
\$ _____. This draft is drawn under Irrevocable Letter of Credit No.

_____.

[Beneficiary Agency]

By: _____

(End of clause)

52.228-15 PERFORMANCE AND PAYMENT BONDS--CONSTRUCTION (JUL 2000)-

(a) Definitions. As used in this clause--

Original contract price means the award price of the contract; or, for requirements contracts, the price payable for the estimated total quantity; or, for indefinite-quantity contracts, the price payable for the specified minimum quantity. Original contract price does not include the price of any options, except those options exercised at the time of contract award.

(b) Amount of required bonds. Unless the resulting contract price is \$100,000 or less, the successful offeror shall furnish performance and payment bonds to the Contracting Officer as follows:

(1) Performance bonds (Standard Form 25). The penal amount of performance bonds at the time of contract award shall be 100 percent of the original contract price.

(2) Payment Bonds (Standard Form 25-A). The penal amount of payment bonds at the time of contract award shall be 100 percent of the original contract price.

(3) Additional bond protection. (i) The Government may require additional performance and payment bond protection if the contract price is increased. The increase in protection generally will equal 100 percent of the increase in contract price.

(ii) The Government may secure the additional protection by directing the Contractor to increase the penal amount of the existing bond or to obtain an additional bond.

(c) Furnishing executed bonds. The Contractor shall furnish all executed bonds, including any necessary reinsurance agreements, to the Contracting Officer, within the time period specified in the Bid Guarantee provision of the solicitation, or otherwise specified by the Contracting Officer, but in any event, before starting work.

(d) Surety or other security for bonds. The bonds shall be in the form of firm commitment, supported by corporate sureties whose names appear on the list contained in Treasury Department Circular 570, individual sureties, or by other acceptable security such as postal money order, certified check, cashier's check, irrevocable letter of credit, or, in accordance with Treasury Department regulations, certain bonds or notes of the United States. Treasury Circular 570 is published in the Federal Register or may be obtained from the U.S. Department of Treasury, Financial Management Service, Surety Bond Branch, 401 14th Street, NW, 2nd Floor, West Wing, Washington, DC 20227.

(e) Notice of subcontractor waiver of protection (40 U.S.C. 270b(c)). Any waiver of the right to sue on the payment bond is void unless it is in writing, signed by the person whose right is waived, and executed after such person has first furnished labor or material for use in the performance of the contract.

(End of clause)

52.232-5 PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS (SEP 2002)

(a) Payment of price. The Government shall pay the Contractor the contract price as provided in this contract.

(b) Progress payments. The Government shall make progress payments monthly as the work proceeds, or at more frequent intervals as determined by the Contracting Officer, on estimates of work accomplished which meets the standards of quality established under the contract, as approved by the Contracting Officer.

(1) The Contractor's request for progress payments shall include the following substantiation:

(i) An itemization of the amounts requested, related to the various elements of work required by the contract covered by the payment requested.

(ii) A listing of the amount included for work performed by each subcontractor under the contract.

(iii) A listing of the total amount of each subcontract under the contract.

(iv) A listing of the amounts previously paid to each such subcontractor under the contract.

(v) Additional supporting data in a form and detail required by the Contracting Officer.

(2) In the preparation of estimates, the Contracting Officer may authorize material delivered on the site and preparatory work done to be taken into consideration. Material delivered to the Contractor at locations other than the site also may be taken into consideration if--

(i) Consideration is specifically authorized by this contract; and

(ii) The Contractor furnishes satisfactory evidence that it has acquired title to such material and that the material will be used to perform this contract.

(c) Contractor certification. Along with each request for progress payments, the Contractor shall furnish the following certification, or payment shall not be made: (However, if the Contractor elects to delete paragraph (c)(4) from the certification, the certification is still acceptable.)

I hereby certify, to the best of my knowledge and belief, that--

(1) The amounts requested are only for performance in accordance with the specifications, terms, and conditions of the contract;

(2) All payments due to subcontractors and suppliers from previous payments received under the contract have been made, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract agreements and the requirements of chapter 39 of Title 31, United States Code;

(3) This request for progress payments does not include any amounts which the prime contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract; and

(4) This certification is not to be construed as final acceptance of a subcontractor's performance.

(Name)

(Title)

(Date)

(d) Refund of unearned amounts. If the Contractor, after making a certified request for progress payments, discovers that a portion or all of such request constitutes a payment for performance by the Contractor that fails to conform to the specifications, terms, and conditions of this contract (hereinafter referred to as the "unearned amount"), the Contractor shall--

(1) Notify the Contracting Officer of such performance deficiency; and

(2) Be obligated to pay the Government an amount (computed by the Contracting Officer in the manner provided in paragraph (j) of this clause) equal to interest on the unearned amount from the 8th day after the date of receipt of the unearned amount until--

(i) The date the Contractor notifies the Contracting Officer that the performance deficiency has been corrected; or

(ii) The date the Contractor reduces the amount of any subsequent certified request for progress payments by an amount equal to the unearned amount.

(e) Retainage. If the Contracting Officer finds that satisfactory progress was achieved during any period for which a progress payment is to be made, the Contracting Officer shall authorize payment to be made in full. However, if satisfactory progress has not been made, the Contracting Officer may retain a maximum of 10 percent of the amount of the payment until satisfactory progress is achieved. When the work is substantially complete, the Contracting

Officer may retain from previously withheld funds and future progress payments that amount the Contracting Officer considers adequate for protection of the Government and shall release to the Contractor all the remaining withheld funds. Also, on completion and acceptance of each separate building, public work, or other division of the contract, for which the price is stated separately in the contract, payment shall be made for the completed work without retention of a percentage.

(f) Title, liability, and reservation of rights. All material and work covered by progress payments made shall, at the time of payment, become the sole property of the Government, but this shall not be construed as--

(1) Relieving the Contractor from the sole responsibility for all material and work upon which payments have been made or the restoration of any damaged work; or

(2) Waiving the right of the Government to require the fulfillment of all of the terms of the contract.

(g) Reimbursement for bond premiums. In making these progress payments, the Government shall, upon request, reimburse the Contractor for the amount of premiums paid for performance and payment bonds (including coinsurance and reinsurance agreements, when applicable) after the Contractor has furnished evidence of full payment to the surety. The retainage provisions in paragraph (e) of this clause shall not apply to that portion of progress payments attributable to bond premiums.

(h) Final payment. The Government shall pay the amount due the Contractor under this contract after--

(1) Completion and acceptance of all work;

(2) Presentation of a properly executed voucher; and

(3) Presentation of release of all claims against the Government arising by virtue of this contract, other than claims, in stated amounts, that the Contractor has specifically excepted from the operation of the release. A release may also be required of the assignee if the Contractor's claim to amounts payable under this contract has been assigned under the Assignment of Claims Act of 1940 (31 U.S.C. 3727 and 41 U.S.C. 15).

(i) Limitation because of undefinitized work. Notwithstanding any provision of this contract, progress payments shall not exceed 80 percent on work accomplished on undefinitized contract actions. A "contract action" is any action resulting in a contract, as defined in FAR Subpart 2.1, including contract modifications for additional supplies or services, but not including contract modifications that are within the scope and under the terms of the contract, such as contract modifications issued pursuant to the Changes clause, or funding and other administrative changes.

(j) Interest computation on unearned amounts. In accordance with 31 U.S.C. 3903(c)(1), the amount payable under subparagraph (d)(2) of this clause shall be--

(1) Computed at the rate of average bond equivalent rates of 91-day Treasury bills auctioned at the most recent auction of such bills prior to the date the Contractor receives the unearned amount; and

(2) Deducted from the next available payment to the Contractor.

(End of clause)

52.232-17 INTEREST (JUNE 1996)

(a) Except as otherwise provided in this contract under a Price Reduction for Defective Cost or Pricing Data clause or

a Cost Accounting Standards clause, all amounts that become payable by the Contractor to the Government under this contract (net of any applicable tax credit under the Internal Revenue Code (26 U.S.C. 1481)) shall bear simple interest from the date due until paid unless paid within 30 days of becoming due. The interest rate shall be the interest rate established by the Secretary of the Treasury as provided in Section 12 of the Contract Disputes Act of 1978 (Public Law 95-563), which is applicable to the period in which the amount becomes due, as provided in paragraph (b) of this clause, and then at the rate applicable for each six-month period as fixed by the Secretary until the amount is paid. reproduce, prepare derivative works, distribute copies to the public, and (b) Amounts shall be due at the earliest of the following dates:

- (1) The date fixed under this contract.
- (2) The date of the first written demand for payment consistent with this contract, including any demand resulting from a default termination.
- (3) The date the Government transmits to the Contractor a proposed supplemental agreement to confirm completed negotiations establishing the amount of debt.
- (4) If this contract provides for revision of prices, the date of written notice to the Contractor stating the amount of refund payable in connection with a pricing proposal or a negotiated pricing agreement not confirmed by contract modification.
- (c) The interest charge made under this clause may be reduced under the procedures prescribed in 32.614-2 of the Federal Acquisition Regulation in effect on the date of this contract.

(End of clause)

52.232-23 ASSIGNMENT OF CLAIMS (JAN 1986) - ALTERNATE I (APR 1984)

(a) The Contractor, under the Assignment of Claims Act, as amended, 31 U.S.C. 3727, 41 U.S.C. 15 (hereafter referred to as "the Act"), may assign its rights to be paid amounts due or to become due as a result of the performance of this contract to a bank, trust company, or other financing institution, including any Federal lending agency. The assignee under such an assignment may thereafter further assign or reassign its right under the original assignment to any type of financing institution described in the preceding sentence. Unless otherwise stated in this contract, payments to an assignee of any amounts due or to become due under this contract shall not, to the extent specified in the Act, be subject to reduction or setoff.

(b) Any assignment or reassignment authorized under the Act and this clause shall cover all unpaid amounts payable under this contract, and shall not be made to more than one party, except that an assignment or reassignment may be made to one party as agent or trustee for two or more parties participating in the financing of this contract.

(c) The Contractor shall not furnish or disclose to any assignee under this contract any classified document (including this contract) or information related to work under this contract until the Contracting Officer authorizes such action in writing.

(End of clause)

52.232-27 PROMPT PAYMENT FOR CONSTRUCTION CONTRACTS (OCT 2003)

Notwithstanding any other payment terms in this contract, the Government will make invoice payments under the terms and conditions specified in this clause. The Government considers payment as being made on the day a check is dated or the date of an electronic funds transfer. Definitions of pertinent terms are set forth in sections 2.101, 32.001, and 32.902 of the Federal Acquisition Regulation. All days referred to in this clause are calendar days, unless otherwise specified. (However, see paragraph (a)(3) concerning payments due on Saturdays, Sundays, and legal holidays.)

(a) Invoice payments--(1) Types of invoice payments. For purposes of this clause, there are several types of invoice payments that may occur under this contract, as follows:

(i) Progress payments, if provided for elsewhere in this contract, based on Contracting Officer approval of the estimated amount and value of work or services performed, including payments for reaching milestones in any project.

(A) The due date for making such payments is 14 days after the designated billing office receives a proper payment request. If the designated billing office fails to annotate the payment request with the actual date of receipt at the time of receipt, the payment due date is the 14th day after the date of the Contractor's payment request, provided the designated billing office receives a proper payment request and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(B) The due date for payment of any amounts retained by the Contracting Officer in accordance with the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts, is as specified in the contract or, if not specified, 30 days after approval by the Contracting Officer for release to the Contractor.

(ii) Final payments based on completion and acceptance of all work and presentation of release of all claims against the Government arising by virtue of the contract, and payments for partial deliveries that have been accepted by the Government (e.g., each separate building, public work, or other division of the contract for which the price is stated separately in the contract).

(A) The due date for making such payments is the later of the following two events:

(1) The 30th day after the designated billing office receives a proper invoice from the Contractor.

(2) The 30th day after Government acceptance of the work or services completed by the Contractor. For a final invoice when the payment amount is subject to contract settlement actions (e.g., release of claims), acceptance is deemed to occur on the effective date of the contract settlement.

(B) If the designated billing office fails to annotate the invoice with the date of actual receipt at the time of receipt, the invoice payment due date is the 30th day after the date of the Contractor's invoice, provided the designated billing office receives a proper invoice and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(2) Contractor's invoice. The Contractor shall prepare and submit invoices to the designated billing office specified in the contract. A proper invoice must include the items listed in paragraphs (a)(2)(i) through (a)(2)(xi) of this clause. If the invoice does not comply with these requirements, the designated billing office must return it within 7 days after receipt, with the reasons why it is not a proper invoice. When computing any interest penalty owed the Contractor, the Government will take into account if the Government notifies the Contractor of an improper invoice in an untimely manner.

(i) Name and address of the Contractor.

(ii) Invoice date and invoice number. (The Contractor should date invoices as close as possible to the date of mailing or transmission.)

(iii) Contract number or other authorization for work or services performed (including order number and contract line item number).

(iv) Description of work or services performed.

(v) Delivery and payment terms (e.g., discount for prompt payment terms).

(vi) Name and address of Contractor official to whom payment is to be sent (must be the same as that in the contract or in a proper notice of assignment).

(vii) Name (where practicable), title, phone number, and mailing address of person to notify in the event of a defective invoice.

(viii) For payments described in paragraph (a)(1)(i) of this clause, substantiation of the amounts requested and certification in accordance with the requirements of the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts.

(ix) Taxpayer Identification Number (TIN). The Contractor shall include its TIN on the invoice only if required elsewhere in this contract.

(x) Electronic funds transfer (EFT) banking information.

(A) The Contractor shall include EFT banking information on the invoice only if required elsewhere in this contract.

(B) If EFT banking information is not required to be on the invoice, in order for the invoice to be a proper invoice, the Contractor shall have submitted correct EFT banking information in accordance with the applicable solicitation provision (e.g., 52.232-38, Submission of Electronic Funds Transfer Information with Offer), contract clause (e.g., 52.232-33, Payment by Electronic Funds Transfer--Central Contractor Registration, or 52.232-34, Payment by Electronic Funds Transfer--Other Than Central Contractor Registration), or applicable agency procedures.

(C) EFT banking information is not required if the Government waived the requirement to pay by EFT.

(xi) Any other information or documentation required by the contract.

(3) Interest penalty. The designated payment office will pay an interest penalty automatically, without request from the Contractor, if payment is not made by the due date and the conditions listed in paragraphs (a)(3)(i) through (a)(3)(iii) of this clause are met, if applicable. However, when the due date falls on a Saturday, Sunday, or legal holiday, the designated payment office may make payment on the following working day without incurring a late payment interest penalty.

(i) The designated billing office received a proper invoice.

(ii) The Government processed a receiving report or other Government documentation authorizing payment and there was no disagreement over quantity, quality, Contractor compliance with any contract term or condition, or requested progress payment amount.

(iii) In the case of a final invoice for any balance of funds due the Contractor for work or services performed, the amount was not subject to further contract settlement actions between the Government and the Contractor.

(4) Computing penalty amount. The Government will compute the interest penalty in accordance with the Office of Management and Budget prompt payment regulations at 5 CFR part 1315.

(i) For the sole purpose of computing an interest penalty that might be due the Contractor for payments described in paragraph (a)(1)(ii) of this clause, Government acceptance or approval is deemed to occur constructively on the 7th day after the Contractor has completed the work or services in accordance with the terms and conditions of the contract. If actual acceptance or approval occurs within the constructive acceptance or approval period, the Government will base the determination of an interest penalty on the actual date of acceptance or approval. Constructive acceptance or constructive approval requirements do not apply if there is a disagreement over quantity, quality, or Contractor compliance with a contract provision. These requirements also do not compel Government officials to accept work or services, approve Contractor estimates, perform contract administration functions, or make payment prior to fulfilling their responsibilities.

(ii) The prompt payment regulations at 5 CFR 1315.10(c) do not require the Government to pay interest penalties if payment delays are due to disagreement between the Government and the Contractor over the payment amount or other issues involving contract compliance, or on amounts temporarily withheld or retained in accordance with the terms of the contract. The Government and the Contractor shall resolve claims involving disputes, and any interest that may be payable in accordance with the clause at FAR 52.233-1, Disputes.

(5) Discounts for prompt payment. The designated payment office will pay an interest penalty automatically, without request from the Contractor, if the Government takes a discount for prompt payment improperly. The Government will calculate the interest penalty in accordance with the prompt payment regulations at 5 CFR part 1315.

(6) Additional interest penalty. (i) The designated payment office will pay a penalty amount, calculated in accordance with the prompt payment regulations at 5 CFR part 1315 in addition to the interest penalty amount only if--

(A) The Government owes an interest penalty of \$1 or more;

(B) The designated payment office does not pay the interest penalty within 10 days after the date the invoice amount is paid; and

(C) The Contractor makes a written demand to the designated payment office for additional penalty payment, in accordance with paragraph (a)(6)(ii) of this clause, postmarked not later than 40 days after the date the invoice amount is paid.

(ii)(A) The Contractor shall support written demands for additional penalty payments with the following data. The Government will not request any additional data. The Contractor shall--

(1) Specifically assert that late payment interest is due under a specific invoice, and request payment of all overdue late payment interest penalty and such additional penalty as may be required;

(2) Attach a copy of the invoice on which the unpaid late payment interest was due; and

(3) State that payment of the principal has been received, including the date of receipt.

(B) If there is no postmark or the postmark is illegible--

(1) The designated payment office that receives the demand will annotate it with the date of receipt provided the demand is received on or before the 40th day after payment was made; or

(2) If the designated payment office fails to make the required annotation, the Government will determine the demand's validity based on the date the Contractor has placed on the demand, provided such date is no later than the 40th day after payment was made.

(b) Contract financing payments. If this contract provides for contract financing, the Government will make contract financing payments in accordance with the applicable contract financing clause.

(c) Subcontract clause requirements. The Contractor shall include in each subcontract for property or services (including a material supplier) for the purpose of performing this contract the following:

(1) Prompt payment for subcontractors. A payment clause that obligates the Contractor to pay the subcontractor for satisfactory performance under its subcontract not later than 7 days from receipt of payment out of such amounts as are paid to the Contractor under this contract.

(2) Interest for subcontractors. An interest penalty clause that obligates the Contractor to pay to the subcontractor an interest penalty for each payment not made in accordance with the payment clause--

(i) For the period beginning on the day after the required payment date and ending on the date on which payment of the amount due is made; and

(ii) Computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(3) Subcontractor clause flowdown. A clause requiring each subcontractor to use:

(i) Include a payment clause and an interest penalty clause conforming to the standards set forth in paragraphs (c)(1) and (c)(2) of this clause in each of its subcontracts; and

(ii) Require each of its subcontractors to include such clauses in their subcontracts with each lower-tier subcontractor or supplier.

(d) Subcontract clause interpretation. The clauses required by paragraph (c) of this clause shall not be construed to impair the right of the Contractor or a subcontractor at any tier to negotiate, and to include in their subcontract, provisions that--

(1) Retainage permitted. Permit the Contractor or a subcontractor to retain (without cause) a specified percentage of each progress payment otherwise due to a subcontractor for satisfactory performance under the subcontract without incurring any obligation to pay a late payment interest penalty, in accordance with terms and conditions agreed to by the parties to the subcontract, giving such recognition as the parties deem appropriate to the ability of a subcontractor to furnish a performance bond and a payment bond;

(2) Withholding permitted. Permit the Contractor or subcontractor to make a determination that part or all of the subcontractor's request for payment may be withheld in accordance with the subcontract agreement; and

(3) Withholding requirements. Permit such withholding without incurring any obligation to pay a late payment penalty if--

(i) A notice conforming to the standards of paragraph (g) of this clause previously has been furnished to the subcontractor; and

(ii) The Contractor furnishes to the Contracting Officer a copy of any notice issued by a Contractor pursuant to paragraph (d)(3)(i) of this clause.

(e) Subcontractor withholding procedures. If a Contractor, after making a request for payment to the Government but before making a payment to a subcontractor for the subcontractor's performance covered by the payment request, discovers that all or a portion of the payment otherwise due such subcontractor is subject to withholding from the subcontractor in accordance with the subcontract agreement, then the Contractor shall--

(1) Subcontractor notice. Furnish to the subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon ascertaining the cause giving rise to a withholding, but prior to the due date for subcontractor payment;

(2) Contracting Officer notice. Furnish to the Contracting Officer, as soon as practicable, a copy of the notice furnished to the subcontractor pursuant to paragraph (e)(1) of this clause;

(3) Subcontractor progress payment reduction. Reduce the subcontractor's progress payment by an amount not to exceed the amount specified in the notice of withholding furnished under paragraph (e)(1) of this clause;

(4) Subsequent subcontractor payment. Pay the subcontractor as soon as practicable after the correction of the identified subcontract performance deficiency, and--

(i) Make such payment within--

(A) Seven days after correction of the identified subcontract performance deficiency (unless the funds therefor must be recovered from the Government because of a reduction under paragraph (e)(5)(i)) of this clause; or

(B) Seven days after the Contractor recovers such funds from the Government; or

(ii) Incur an obligation to pay a late payment interest penalty computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty;

(5) Notice to Contracting Officer. Notify the Contracting Officer upon--

(i) Reduction of the amount of any subsequent certified application for payment; or

(ii) Payment to the subcontractor of any withheld amounts of a progress payment, specifying--

(A) The amounts withheld under paragraph (e)(1) of this clause; and

(B) The dates that such withholding began and ended; and

(6) Interest to Government. Be obligated to pay to the Government an amount equal to interest on the withheld payments (computed in the manner provided in 31 U.S.C. 3903(c)(1)), from the 8th day after receipt of the withheld amounts from the Government until--

(i) The day the identified subcontractor performance deficiency is corrected; or

(ii) The date that any subsequent payment is reduced under paragraph (e)(5)(i) of this clause.

(f) Third-party deficiency reports--(1) Withholding from subcontractor. If a Contractor, after making payment to a first-tier subcontractor, receives from a supplier or subcontractor of the first-tier subcontractor (hereafter referred to as a "second-tier subcontractor") a written notice in accordance with section 2 of the Act of August 24, 1935 (40 U.S.C. 270b, Miller Act), asserting a deficiency in such first-tier subcontractor's performance under the contract for which the Contractor may be ultimately liable, and the Contractor determines that all or a portion of future payments otherwise due such first-tier subcontractor is subject to withholding in accordance with the subcontract agreement, the Contractor may, without incurring an obligation to pay an interest penalty under paragraph (e)(6) of this clause--

(i) Furnish to the first-tier subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon making such determination; and

(ii) Withhold from the first-tier subcontractor's next available progress payment or payments an amount not to exceed the amount specified in the notice of withholding furnished under paragraph (f)(1)(i) of this clause.

(2) Subsequent payment or interest charge. As soon as practicable, but not later than 7 days after receipt of satisfactory written notification that the identified subcontract performance deficiency has been corrected, the Contractor shall--

(i) Pay the amount withheld under paragraph (f)(1)(ii) of this clause to such first-tier subcontractor; or

(ii) Incur an obligation to pay a late payment interest penalty to such first-tier subcontractor computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(g) Written notice of subcontractor withholding. The Contractor shall issue a written notice of any withholding to a subcontractor (with a copy furnished to the Contracting Officer), specifying--

(1) The amount to be withheld;

(2) The specific causes for the withholding under the terms of the subcontract; and

(3) The remedial actions to be taken by the subcontractor in order to receive payment of the amounts withheld.

(h) Subcontractor payment entitlement. The Contractor may not request payment from the Government of any amount withheld or retained in accordance with paragraph (d) of this clause until such time as the Contractor has determined and certified to the Contracting Officer that the subcontractor is entitled to the payment of such amount.

(i) Prime-subcontractor disputes. A dispute between the Contractor and subcontractor relating to the amount or entitlement of a subcontractor to a payment or a late payment interest penalty under a clause included in the subcontract pursuant to paragraph (c) of this clause does not constitute a dispute to which the Government is a party. The Government may not be interpleaded in any judicial or administrative proceeding involving such a dispute.

(j) Preservation of prime-subcontractor rights. Except as provided in paragraph (i) of this clause, this clause shall not limit or impair any contractual, administrative, or judicial remedies otherwise available to the Contractor or a subcontractor in the event of a dispute involving late payment or nonpayment by the Contractor or deficient subcontract performance or nonperformance by a subcontractor.

(k) Non-recourse for prime contractor interest penalty. The Contractor's obligation to pay an interest penalty to a subcontractor pursuant to the clauses included in a subcontract under paragraph (c) of this clause shall not be construed to be an obligation of the Government for such interest penalty. A cost-reimbursement claim may not include any amount for reimbursement of such interest penalty.

(l) Overpayments. If the Contractor becomes aware of a duplicate contract financing or invoice payment or that the Government has otherwise overpaid on a contract financing or invoice payment, the Contractor shall immediately notify the Contracting Officer and request instructions for disposition of the overpayment.

(End of clause)

52.232-33 PAYMENT BY ELECTRONIC FUNDS TRANSFER—CENTRAL CONTRACTOR REGISTRATION (OCT 2003)

(a) Method of payment. (1) All payments by the Government under this contract shall be made by electronic funds transfer (EFT), except as provided in paragraph (a)(2) of this clause. As used in this clause, the term "EFT" refers to the funds transfer and may also include the payment information transfer.

(2) In the event the Government is unable to release one or more payments by EFT, the Contractor agrees to either--

(i) Accept payment by check or some other mutually agreeable method of payment; or

(ii) Request the Government to extend the payment due date until such time as the Government can make payment by EFT (but see paragraph (d) of this clause).

(b) Contractor's EFT information. The Government shall make payment to the Contractor using the EFT information contained in the Central Contractor Registration (CCR) database. In the event that the EFT information changes, the Contractor shall be responsible for providing the updated information to the CCR database.

(c) Mechanisms for EFT payment. The Government may make payment by EFT through either the Automated Clearing House (ACH) network, subject to the rules of the National Automated Clearing House Association, or the Fedwire Transfer System. The rules governing Federal payments through the ACH are contained in 31 CFR part 210.

(d) Suspension of payment. If the Contractor's EFT information in the CCR database is incorrect, then the Government need not make payment to the Contractor under this contract until correct EFT information is entered into the CCR database; and any invoice or contract financing request shall be deemed not to be a proper invoice for the purpose of prompt payment under this contract. The prompt payment terms of the contract regarding notice of an improper invoice and delays in accrual of interest penalties apply.

(e) Liability for uncompleted or erroneous transfers. (1) If an uncompleted or erroneous transfer occurs because the Government used the Contractor's EFT information incorrectly, the Government remains responsible for--

(i) Making a correct payment;

(ii) Paying any prompt payment penalty due; and

(iii) Recovering any erroneously directed funds.

(2) If an uncompleted or erroneous transfer occurs because the Contractor's EFT information was incorrect, or was revised within 30 days of Government release of the EFT payment transaction instruction to the Federal Reserve System, and--

(i) If the funds are no longer under the control of the payment office, the Government is deemed to have made payment and the Contractor is responsible for recovery of any erroneously directed funds; or

(ii) If the funds remain under the control of the payment office, the Government shall not make payment, and the provisions of paragraph (d) of this clause shall apply.

(f) EFT and prompt payment. A payment shall be deemed to have been made in a timely manner in accordance with the prompt payment terms of this contract if, in the EFT payment transaction instruction released to the Federal Reserve System, the date specified for settlement of the payment is on or before the prompt payment due date, provided the specified payment date is a valid date under the rules of the Federal Reserve System.

(g) EFT and assignment of claims. If the Contractor assigns the proceeds of this contract as provided for in the assignment of claims terms of this contract, the Contractor shall require as a condition of any such assignment, that the assignee shall register separately in the CCR database and shall be paid by EFT in accordance with the terms of this clause. Notwithstanding any other requirement of this contract, payment to an ultimate recipient other than the Contractor, or a financial institution properly recognized under an assignment of claims pursuant to subpart 32.8, is not permitted. In all respects, the requirements of this clause shall apply to the assignee as if it were the Contractor. EFT information that shows the ultimate recipient of the transfer to be other than the Contractor, in the absence of a proper assignment of claims acceptable to the Government, is incorrect EFT information within the meaning of paragraph (d) of this clause.

(h) Liability for change of EFT information by financial agent. The Government is not liable for errors resulting from changes to EFT information made by the Contractor's financial agent.

(i) Payment information. The payment or disbursing office shall forward to the Contractor available payment information that is suitable for transmission as of the date of release of the EFT instruction to the Federal Reserve System. The Government may request the Contractor to designate a desired format and method(s) for delivery of payment information from a list of formats and methods the payment office is capable of executing. However, the Government does not guarantee that any particular format or method of delivery is available at any particular payment office and retains the latitude to use the format and delivery method most convenient to the Government. If the Government makes payment by check in accordance with paragraph (a) of this clause, the Government shall mail the payment information to the remittance address contained in the CCR database.

(End of Clause)

52.233-1 DISPUTES. (JUL 2002)

(a) This contract is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613).

(b) Except as provided in the Act, all disputes arising under or relating to this contract shall be resolved under this clause.

(c) Claim, as used in this clause, means a written demand or written assertion by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of contract terms, or other relief arising under or relating to this contract. However, a written demand or written assertion by the Contractor seeking the payment of money exceeding \$100,000 is not a claim under the Act until certified. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim under the Act. The submission may be converted to a claim under the Act, by complying with the submission and certification requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

(d)(1) A claim by the Contractor shall be made in writing and, unless otherwise stated in this contract, submitted within 6 years after accrual of the claim to the Contracting Officer for a written decision. A claim by the Government against the Contractor shall be subject to a written decision by the Contracting Officer.

(2)(i) The contractors shall provide the certification specified in subparagraph (d)(2)(iii) of this clause when submitting any claim -

(A) Exceeding \$100,000; or

(B) Regardless of the amount claimed, when using -

(1) Arbitration conducted pursuant to 5 U.S.C. 575-580; or

(2) Any other alternative means of dispute resolution (ADR) technique that the agency elects to handle in accordance with the Administrative Dispute Resolution Act (ADRA).

(ii) The certification requirement does not apply to issues in controversy that have not been submitted as all or part of a claim.

(iii) The certification shall state as follows: "I certify that the claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Contractor believes the Government is liable; and that I am duly authorized to certify the claim on behalf of the Contractor.

(3) The certification may be executed by any person duly authorized to bind the Contractor with respect to the claim.

(e) For Contractor claims of \$100,000 or less, the Contracting Officer must, if requested in writing by the Contractor, render a decision within 60 days of the request. For Contractor-certified claims over \$100,000, the Contracting Officer must, within 60 days, decide the claim or notify the Contractor of the date by which the decision will be made.

(f) The Contracting Officer's decision shall be final unless the Contractor appeals or files a suit as provided in the Act.

(g) If the claim by the Contractor is submitted to the Contracting Officer or a claim by the Government is presented to the Contractor, the parties, by mutual consent, may agree to use alternative dispute resolution (ADR). If the Contractor refuses an offer for ADR, the Contractor shall inform the Contracting Officer, in writing, of the Contractor's specific reasons for rejecting the request.

(h) The Government shall pay interest on the amount found due and unpaid from (1) the date the Contracting Officer receives the claim (certified, if required); or (2) the date that payment otherwise would be due, if that date is later, until the date of payment. With regard to claims having defective certifications, as defined in (FAR) 48 CFR 33.201, interest shall be paid from the date that the Contracting Officer initially receives the claim. Simple interest on claims shall be paid at the rate, fixed by the Secretary of the Treasury as provided in the Act, which is applicable to the period during which the Contracting Officer receives the claim and then at the rate applicable for each 6-month period as fixed by the Treasury Secretary during the pendency of the claim.

(i) The Contractor shall proceed diligently with performance of this contract, pending final resolution of any request for relief, claim, appeal, or action arising under the contract, and comply with any decision of the Contracting Officer.

(End of clause)

52.233-3 PROTEST AFTER AWARD (AUG. 1996)

(a) Upon receipt of a notice of protest (as defined in FAR 33.101) or a determination that a protest is likely (see FAR 33.102(d)), the Contracting Officer may, by written order to the Contractor, direct the Contractor to stop performance of the work called for by this contract. The order shall be specifically identified as a stop-work order issued under this clause. Upon receipt of the order, the Contractor shall immediately comply with its terms and take all reasonable steps to minimize the incurrence of costs allocable to the work covered by the order during the period of work stoppage. Upon receipt of the final decision in the protest, the Contracting Officer shall either--

(1) Cancel the stop-work order; or

(2) Terminate the work covered by the order as provided in the Default, or the Termination for Convenience of the

Government, clause of this contract.

(b) If a stop-work order issued under this clause is canceled either before or after a final decision in the protest, the Contractor shall resume work. The Contracting Officer shall make an equitable adjustment in the delivery schedule or contract price, or both, and the contract shall be modified, in writing, accordingly, if--

(1) The stop-work order results in an increase in the time required for, or in the Contractor's cost properly allocable to, the performance of any part of this contract; and

(2) The Contractor asserts its right to an adjustment within 30 days after the end of the period of work stoppage; provided, that if the Contracting Officer decides the facts justify the action, the Contracting Officer may receive and act upon a proposal at any time before final payment under this contract.

(c) If a stop-work order is not canceled and the work covered by the order is terminated for the convenience of the Government, the Contracting Officer shall allow reasonable costs resulting from the stop-work order in arriving at the termination settlement.

(d) If a stop-work order is not canceled and the work covered by the order is terminated for default, the Contracting Officer shall allow, by equitable adjustment or otherwise, reasonable costs resulting from the stop-work order.

(e) The Government's rights to terminate this contract at any time are not affected by action taken under this clause.

(f) If, as the result of the Contractor's intentional or negligent misstatement, misrepresentation, or miscertification, a protest related to this contract is sustained, and the Government pays costs, as provided in FAR 33.102(b)(2) or 33.104(h)(1), the Government may require the Contractor to reimburse the Government the amount of such costs. In addition to any other remedy available, and pursuant to the requirements of Subpart 32.6, the Government may collect this debt by offsetting the amount against any payment due the Contractor under any contract between the Contractor and the Government.

(End of clause)

52.236-2 DIFFERING SITE CONDITIONS (APR 1984)

As prescribed in 36.502, insert the following clause in solicitations and contracts when a fixed-price construction contract or a fixed-price dismantling, demolition, or removal of improvements contract is contemplated and the contract amount is expected to exceed the small purchase limitation. The Contracting Officer may insert the clause in solicitations and contracts when a fixed-price construction or a fixed-price contract for dismantling, demolition, or removal of improvements is contemplated and the contract amount is expected to be within the small purchase limitation.

(a) The Contractor shall promptly, and before the conditions are disturbed, give a written notice to the Contracting Officer of

(1) subsurface or latent physical conditions at the site which differ materially from those indicated in this contract, or

(2) unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the contract.

(b) The Contracting Officer shall investigate the site conditions promptly after receiving the notice. If the conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performing any part of the work under this contract, whether or not changed as a result of the conditions, an

equitable adjustment shall be made under this clause and the contract modified in writing accordingly.

(c) No request by the Contractor for an equitable adjustment to the contract under this clause shall be allowed, unless the Contractor has given the written notice required; provided, that the time prescribed in (a) above for giving written notice may be extended by the Contracting Officer.

(d) No request by the Contractor for an equitable adjustment to the contract for differing site conditions shall be allowed if made after final payment under this contract.

(End of clause)

52.236-3 SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK (APR 1984)

(a) The Contractor acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to

(1) conditions bearing upon transportation, disposal, handling, and storage of materials;

(2) the availability of labor, water, electric power, and roads;

(3) uncertainties of weather, river stages, tides, or similar physical conditions at the site;

(4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the Government, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the Government.

(b) The Government assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by the Government. Nor does the Government assume responsibility for any understanding reached or representation made concerning conditions which can affect the work by any of its officers or agents before the execution of this contract, unless that understanding or representation is expressly stated in this contract.

(End of clause)

52.236-5 MATERIAL AND WORKMANSHIP (APR 1984)

(a) All equipment, material, and articles incorporated into the work covered by this contract shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in this contract. References in the specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of the Contracting Officer, is equal to that named in the specifications, unless otherwise specifically provided in this contract.

(b) The Contractor shall obtain the Contracting Officer's approval of the machinery and mechanical and other equipment to be incorporated into the work. When requesting approval, the Contractor shall furnish to the Contracting Officer the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the machinery and mechanical and other equipment. When required by this contract or by the Contracting Officer, the Contractor shall also obtain the Contracting Officer's approval of the material or articles which the Contractor contemplates incorporating into the work. When requesting approval, the Contractor shall provide full information concerning the material or articles. When directed to do so, the Contractor shall submit samples for approval at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material, and articles that do not have the required approval shall be installed or used at the risk of subsequent rejection.

(c) All work under this contract shall be performed in a skillful and workmanlike manner. The Contracting Officer may require, in writing, that the Contractor remove from the work any employee the Contracting Officer deems incompetent, careless, or otherwise objectionable.

(End of clause)

52.236-6 SUPERINTENDENCE BY THE CONTRACTOR (APR 1984)

At all times during performance of this contract and until the work is completed and accepted, the Contractor shall directly superintend the work or assign and have on the worksite a competent superintendent who is satisfactory to the Contracting Officer and has authority to act for the Contractor.

(End of clause)

52.236-7 PERMITS AND RESPONSIBILITIES (NOV 1991)

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any Federal, State, and municipal laws, codes, and regulations applicable to the performance of the work. The Contractor shall also be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire work, except for any completed unit of work which may have been accepted under the contract.

(End of clause)

52.236-8 OTHER CONTRACTS (APR 1984)

The Government may undertake or award other contracts for additional work at or near the site of the work under this contract. The Contractor shall fully cooperate with the other contractors and with Government employees and shall carefully adapt scheduling and performing the work under this contract to accommodate the additional work, heeding any direction that may be provided by the Contracting Officer. The Contractor shall not commit or permit any act that will interfere with the performance of work by any other contractor or by Government employees.

(End of clause)

52.236-9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS (APR 1984)

(a) The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

(b) The Contractor shall protect from damage all existing improvements and utilities

(1) at or near the work site, and

(2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

(End of clause)

52.236-10 OPERATIONS AND STORAGE AREAS (APR 1984)

(a) The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

(b) Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

(c) The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

(End of clause)

52.236-11 USE AND POSSESSION PRIOR TO COMPLETION (APR 1984)

(a) The Government shall have the right to take possession of or use any completed or partially completed part of the work. Before taking possession of or using any work, the Contracting Officer shall furnish the Contractor a list of items of work remaining to be performed or corrected on those portions of the work that the Government intends to

take possession of or use. However, failure of the Contracting Officer to list any item of work shall not relieve the Contractor of responsibility for complying with the terms of the contract. The Government's possession or use shall not be deemed an acceptance of any work under the contract.

(b) While the Government has such possession or use, the Contractor shall be relieved of the responsibility for the loss of or damage to the work resulting from the Government's possession or use, notwithstanding the terms of the clause in this contract entitled "Permits and Responsibilities." If prior possession or use by the Government delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment shall be made in the contract price or the time of completion, and the contract shall be modified in writing accordingly.

(End of clause)

52.236-12 CLEANING UP (APR 1984)

The Contractor shall at all times keep the work area, including storage areas, free from accumulations of waste materials. Before completing the work, the Contractor shall remove from the work and premises any rubbish, tools, scaffolding, equipment, and materials that are not the property of the Government. Upon completing the work, the Contractor shall leave the work area in a clean, neat, and orderly condition satisfactory to the Contracting Officer.

(End of clause)

52.236-13 ACCIDENT PREVENTION (NOV 1991)

(a) The Contractor shall provide and maintain work environments and procedures which will

(1) safeguard the public and Government personnel, property, materials, supplies, and equipment exposed to Contractor operations and activities;

(2) avoid interruptions of Government operations and delays in project completion dates; and

(3) control costs in the performance of this contract.

(b) For these purposes on contracts for construction or dismantling, demolition, or removal of improvements, the Contractor shall-

(1) Provide appropriate safety barricades, signs, and signal lights;

(2) Comply with the standards issued by the Secretary of Labor at 29 CFR Part 1926 and 29 CFR Part 1910; and

(3) Ensure that any additional measures the Contracting Officer determines to be reasonably necessary for the purposes are taken.

(c) If this contract is for construction or dismantling, demolition or removal of improvements with any Department of Defense agency or component, the Contractor shall comply with all pertinent provisions of the latest version of U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, in effect on the date of the solicitation.

(d) Whenever the Contracting Officer becomes aware of any noncompliance with these requirements or any condition which poses a serious or imminent danger to the health or safety of the public or Government personnel,

the Contracting Officer shall notify the Contractor orally, with written confirmation, and request immediate initiation of corrective action. This notice, when delivered to the Contractor or the Contractor's representative at the work site, shall be deemed sufficient notice of the noncompliance and that corrective action is required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall not be entitled to any equitable adjustment of the contract price or extension of the performance schedule on any stop work order issued under this clause.

- (f) The Contractor shall insert this clause, including this paragraph (e), with appropriate changes in the designation of the parties, in subcontracts.

(End of clause)

52.236-14 AVAILABILITY AND USE OF UTILITY SERVICES (APR 1984)

(a) The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

(b) The Contractor, at its expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

(End of clause)

52.236-15 SCHEDULES FOR CONSTRUCTION CONTRACTS (APR 1984)

(a) The Contractor shall, within five days after the work commences on the contract or another period of time determined by the Contracting Officer, prepare and submit to the Contracting Officer for approval three copies of a practicable schedule showing the order in which the Contractor proposes to perform the work, and the dates on which the Contractor contemplates starting and completing the several salient features of the work (including acquiring materials, plant, and equipment). The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. If the Contractor fails to submit a schedule within the time prescribed, the Contracting Officer may withhold approval of progress payments until the Contractor submits the required schedule.

(b) The Contractor shall enter the actual progress on the chart as directed by the Contracting Officer, and upon doing so shall immediately deliver three copies of the annotated schedule to the Contracting Officer. If, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by the Contracting Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules in chart form as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained.

(c) Failure of the Contractor to comply with the requirements of the Contracting Officer under this clause shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of this contract.

(End of clause)

52.236-17 LAYOUT OF WORK (APR 1984)

The Contractor shall lay out its work from Government established base lines and bench marks indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through its negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

(End of clause)

52.236-21 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FEB 1997)

(a) The Contractor shall keep on the work site a copy of the drawings and specifications and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, the specifications shall govern. In case of discrepancy in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at its own risk and expense. The Contracting Officer shall furnish from time to time such detailed drawings and other information as considered necessary, unless otherwise provided.

(b) Wherever in the specifications or upon the drawings the words "directed", "required", "ordered", "designated", "prescribed", or words of like import are used, it shall be understood that the "direction", "requirement", "order", "designation", or "prescription", of the Contracting Officer is intended and similarly the words "approved", "acceptable", "satisfactory", or words of like import shall mean "approved by," or "acceptable to", or "satisfactory to" the Contracting Officer, unless otherwise expressly stated.

(c) Where "as shown," "as indicated", "as detailed", or words of similar import are used, it shall be understood that the reference is made to the drawings accompanying this contract unless stated otherwise. The word "provided" as used herein shall be understood to mean "provide complete in place," that is "furnished and installed".

(d) Shop drawings means drawings, submitted to the Government by the Contractor, subcontractor, or any lower tier subcontractor pursuant to a construction contract, showing in detail (1) the proposed fabrication and assembly of structural elements, and (2) the installation (i.e., fit, and attachment details) of materials or equipment. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the contractor to explain in detail specific portions of the work required by the contract. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings

delivered under this contract.

(e) If this contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate its approval thereon as evidence of such coordination and review. Shop drawings submitted to the Contracting Officer without evidence of the Contractor's approval may be returned for resubmission. The Contracting Officer will indicate an approval or disapproval of the shop drawings and if not approved as submitted shall indicate the Government's reasons therefor. Any work done before such approval shall be at the Contractor's risk. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with (f) below.

(f) If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Contracting Officer approves any such variation, the Contracting Officer shall issue an appropriate contract modification, except that, if the variation is minor or does not involve a change in price or in time of performance, a modification need not be issued.

(g) The Contractor shall submit to the Contracting Officer for approval four copies (unless otherwise indicated) of all shop drawings as called for under the various headings of these specifications. Three sets (unless otherwise indicated) of all shop drawings, will be retained by the Contracting Officer and one set will be returned to the Contractor.

(End of clause)

52.236-26 PRECONSTRUCTION CONFERENCE (FEB 1995)

If the Contracting Officer decides to conduct a preconstruction conference, the successful offeror will be notified and will be required to attend. The Contracting Officer's notification will include specific details regarding the date, time, and location of the conference, any need for attendance by subcontractors, and information regarding the items to be discussed.

(End of clause)

52.242-13 BANKRUPTCY (JUL 1995)

In the event the Contractor enters into proceedings relating to bankruptcy, whether voluntary or involuntary, the Contractor agrees to furnish, by certified mail or electronic commerce method authorized by the contract, written notification of the bankruptcy to the Contracting Officer responsible for administering the contract. This notification shall be furnished within five days of the initiation of the proceedings relating to bankruptcy filing. This notification shall include the date on which the bankruptcy petition was filed, the identity of the court in which the bankruptcy petition was filed, and a listing of Government contract numbers and contracting offices for all Government contracts against which final payment has not been made. This obligation remains in effect until final payment under this contract.

(End of clause)

52.242-14 SUSPENSION OF WORK (APR 1984)

(a) The Contracting Officer may order the Contractor, in writing, to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate for the convenience of the Government.

(b) If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted (1) by an act of the Contracting Officer in the administration of this contract, or (2) by the Contracting Officer's failure to act within the time specified in this contract (or within a reasonable time if not specified), an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) necessarily caused by the unreasonable suspension, delay, or interruption, and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor, or for which an equitable adjustment is provided for or excluded under any other term or condition of this contract. (c) A claim under this clause shall not be allowed (1) for any costs incurred more than 20 days before the Contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order), and (2) unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of the suspension, delay, or interruption, but not later than the date of final payment under the contract.

(End of clause)

52.243-4 CHANGES (AUG 1987)

(a) The Contracting Officer may, at any time, without notice to the sureties, if any, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract, including changes--

- (1) In the specifications (including drawings and designs);
- (2) In the method or manner of performance of the work;
- (3) In the Government-furnished facilities, equipment, materials, services, or site; or
- (4) Directing acceleration in the performance of the work.

(b) Any other written or oral order (which, as used in this paragraph (b), includes direction, instruction, interpretation, or determination) from the Contracting Officer that causes a change shall be treated as a change order under this clause; provided, that the Contractor gives the Contracting Officer written notice stating

- (1) the date, circumstances, and source of the order and
- (2) that the Contractor regards the order as a change order.

(c) Except as provided in this clause, no order, statement, or conduct of the Contracting Officer shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment.

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this contract, whether or not changed by any such order, the Contracting Officer shall make an equitable adjustment and modify the contract in writing. However, except for an adjustment based on defective specifications, no adjustment for any change under paragraph (b) of this clause shall be made for any costs incurred more than 20 days before the Contractor gives written notice as required. In the case of defective specifications for which the Government is responsible, the equitable adjustment shall include any

increased cost reasonably incurred by the Contractor in attempting to comply with the defective specifications.

(e) The Contractor must assert its right to an adjustment under this clause within 30 days after

(1) receipt of a written change order under paragraph (a) of this clause or (2) the furnishing of a written notice under paragraph (b) of this clause, by submitting to the Contracting Officer a written statement describing the general nature and amount of the proposal, unless this period is extended by the Government. The statement of proposal for adjustment may be included in the notice under paragraph (b) above.

(f) No proposal by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this contract.

(End of clause)

52.246-12 INSPECTION OF CONSTRUCTION (AUG 1996)

(a) Definition. "Work" includes, but is not limited to, materials, workmanship, and manufacture and fabrication of components.

(b) The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. The Contractor shall maintain complete inspection records and make them available to the Government. All work shall be conducted under the general direction of the Contracting Officer and is subject to Government inspection and test at all places and at all reasonable times before acceptance to ensure strict compliance with the terms of the contract.

(c) Government inspections and tests are for the sole benefit of the Government and do not--

(1) Relieve the Contractor of responsibility for providing adequate quality control measures;

(2) Relieve the Contractor of responsibility for damage to or loss of the material before acceptance;

(3) Constitute or imply acceptance; or

(4) Affect the continuing rights of the Government after acceptance of the completed work under paragraph (i) of this section.

(d) The presence or absence of a Government inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the specification without the Contracting Officer's written authorization.

(e) The Contractor shall promptly furnish, at no increase in contract price, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Contracting Officer. The Government may charge to the Contractor any additional cost of inspection or test when work is not ready at the time specified by the Contractor for inspection or test, or when prior rejection makes reinspection or retest necessary. The Government shall perform all inspections and tests in a manner that will not unnecessarily delay the work. Special, full size, and performance tests shall be performed as described in the contract.

(f) The Contractor shall, without charge, replace or correct work found by the Government not to conform to contract requirements, unless in the public interest the Government consents to accept the work with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.

(g) If the Contractor does not promptly replace or correct rejected work, the Government may (1) by contract or otherwise, replace or correct the work and charge the cost to the Contractor or (2) terminate for default the Contractor's right to proceed.

(h) If, before acceptance of the entire work, the Government decides to examine already completed work by removing it or tearing it out, the Contractor, on request, shall promptly furnish all necessary facilities, labor, and material. If the work is found to be defective or nonconforming in any material respect due to the fault of the Contractor or its subcontractors, the Contractor shall defray the expenses of the examination and of satisfactory reconstruction. However, if the work is found to meet contract requirements, the Contracting Officer shall make an equitable adjustment for the additional services involved in the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.

(i) Unless otherwise specified in the contract, the Government shall accept, as promptly as practicable after completion and inspection, all work required by the contract or that portion of the work the Contracting Officer determines can be accepted separately. Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the Government's rights under any warranty or guarantee.

(End of clause)

52.246-21 WARRANTY OF CONSTRUCTION (MAR 1994) - ALTERNATE I (APR 1984)

(a) In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph (i) of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

(b) This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

(c) The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Governmentowned or controlled real or personal property, when that damage is the result of

(1) The Contractor's failure to conform to contract requirements; or

(2) Any defect of equipment, material, workmanship, or design furnished.

(d) The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

(e) The Contracting Officer shall notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect, or damage.

(f) If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, the Government shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

(g) With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall--

- (1) Obtain all warranties that would be given in normal commercial practice;
 - (2) Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and
 - (3) Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.
 - (h) In the event the Contractor's warranty under paragraph (b) of this clause has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.
 - (i) Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage that results from any defect in Government-furnished material or design.
 - (j) This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud.
 - (k) Defects in design or manufacture of equipment specified by the Government on a "brand name and model" basis, shall not be included in this warranty. In this event, the Contractor shall require any subcontractors, manufacturers, or suppliers thereof to execute their warranties, in writing, directly to the Government.
- (End of clause)

52.248-3 VALUE ENGINEERING--CONSTRUCTION (FEB 2000)

(a) General. The Contractor is encouraged to develop, prepare, and submit value engineering change proposals (VECP's) voluntarily. The Contractor shall share in any instant contract savings realized from accepted VECP's, in accordance with paragraph (f) below.

(b) Definitions. "Collateral costs," as used in this clause, means agency costs of operation, maintenance, logistic support, or Government-furnished property.

"Collateral savings," as used in this clause, means those measurable net reductions resulting from a VECP in the agency's overall projected collateral costs, exclusive of acquisition savings, whether or not the acquisition cost changes.

"Contractor's development and implementation costs," as used in this clause, means those costs the Contractor incurs on a VECP specifically in developing, testing, preparing, and submitting the VECP, as well as those costs the Contractor incurs to make the contractual changes required by Government acceptance of a VECP.

"Government costs," as used in this clause, means those agency costs that result directly from developing and implementing the VECP, such as any net increases in the cost of testing, operations, maintenance, and logistic support. The term does not include the normal administrative costs of processing the VECP.

"Instant contract savings," as used in this clause, means the estimated reduction in Contractor cost of performance resulting from acceptance of the VECP, minus allowable Contractor's development and implementation costs, including subcontractors' development and implementation costs (see paragraph (h) below).

"Value engineering change proposal (VECP)" means a proposal that--

- (1) Requires a change to this, the instant contract, to implement; and
 - (2) Results in reducing the contract price or estimated cost without impairing essential functions or characteristics; provided, that it does not involve a change--
 - (i) In deliverable end item quantities only; or
 - (ii) To the contract type only.
 - (c) VECP preparation. As a minimum, the Contractor shall include in each VECP the information described in subparagraphs (1) through (7) below. If the proposed change is affected by contractually required configuration management or similar procedures, the instructions in those procedures relating to format, identification, and priority assignment shall govern VECP preparation. The VECP shall include the following:
 - (1) A description of the difference between the existing contract requirement and that proposed, the comparative advantages and disadvantages of each, a justification when an item's function or characteristics are being altered, and the effect of the change on the end item's performance.
 - (2) A list and analysis of the contract requirements that must be changed if the VECP is accepted, including any suggested specification revisions.
 - (3) A separate, detailed cost estimate for
 - (i) the affected portions of the existing contract requirement and
 - (ii) the VECP. The cost reduction associated with the VECP shall take into account the Contractor's allowable development and implementation costs, including any amount attributable to subcontracts under paragraph (h) below.
 - (4) A description and estimate of costs the Government may incur in implementing the VECP, such as test and evaluation and operating and support costs.
 - (5) A prediction of any effects the proposed change would have on collateral costs to the agency.
 - (6) A statement of the time by which a contract modification accepting the VECP must be issued in order to achieve the maximum cost reduction, noting any effect on the contract completion time or delivery schedule.
 - (7) Identification of any previous submissions of the VECP, including the dates submitted, the agencies and contract numbers involved, and previous Government actions, if known.
 - (d) Submission. The Contractor shall submit VECP's to the Resident Engineer at the worksite, with a copy to the Contracting Officer.
 - (e) Government action.
 - (1) The Contracting Officer will notify the Contractor of the status of the VECP within 45 calendar days after the contracting office receives it. If additional time is required, the Contracting Officer will notify the Contractor within the 45-day period and provide the reason for the delay and the expected date of the decision. The Government will process VECP's expeditiously; however, it shall not be liable for any delay in acting upon a VECP.
- If the VECP is not accepted, the Contracting Officer will notify the Contractor in writing, explaining the reasons for rejection. The Contractor may withdraw any VECP, in whole or in part, at any time before it is accepted by the

Government. The Contracting Officer may require that the Contractor provide written notification before undertaking significant expenditures for VECP effort.

Any VECP may be accepted, in whole or in part, by the Contracting Officer's award of a modification to this contract citing this clause. The Contracting Officer may accept the VECP, even though an agreement on price reduction has not been reached, by issuing the Contractor a notice to proceed with the change. Until a notice to proceed is issued or a contract modification applies a VECP to this contract, the Contractor shall perform in accordance with the existing contract. The decision to accept or reject all or part of any VECP is a unilateral decision made solely at the discretion of the Contracting Officer.

(f) Sharing.

(1) Rates. The Government's share of savings is determined by subtracting Government costs from instant contract savings and multiplying the result by

(i) 45 percent for fixed-price contracts or

(ii) 75 percent for cost-reimbursement contracts.

(2) Payment. Payment of any share due the Contractor for use of a VECP on this contract shall be authorized by a modification to this contract to--

(i) Accept the VECP;

(ii) Reduce the contract price or estimated cost by the amount of instant contract savings; and

(iii) Provide the Contractor's share of savings by adding the amount calculated to the contract price or fee.

(g) Collateral savings. If a VECP is accepted, the Contracting Officer will increase the instant contract amount by 20 percent of any projected collateral savings determined to be realized in a typical year of use after subtracting any Government costs not previously offset. However, the Contractor's share of collateral savings will not exceed the contract's firm-fixed-price or estimated cost, at the time the VECP is accepted, or \$100,000, whichever is greater. The Contracting Officer is the sole determiner of the amount of collateral savings.

(h) Subcontracts. The Contractor shall include an appropriate value engineering clause in any subcontract of \$50,000 or more and may include one in subcontracts of lesser value. In computing any adjustment in this contract's price under paragraph (f) above, the Contractor's allowable development and implementation costs shall include any subcontractor's allowable development and implementation costs clearly resulting from a VECP accepted by the Government under this contract, but shall exclude any value engineering incentive payments to a subcontractor. The Contractor may choose any arrangement for subcontractor value engineering incentive payments; provided, that these payments shall not reduce the Government's share of the savings resulting from the VECP.

(i) Data. The Contractor may restrict the Government's right to use any part of a VECP or the supporting data by marking the following legend on the affected parts:

"These data, furnished under the Value Engineering-- Construction clause of contract, shall not be disclosed outside the Government or duplicated, used, or disclosed, in whole or in part, for any purpose other than to evaluate a value engineering change proposal submitted under the clause. This restriction does not limit the Government's right to use information contained in these data if it has been obtained or is otherwise available from the Contractor or from another source without limitations." If a VECP is accepted, the Contractor hereby grants the Government unlimited rights in the VECP and supporting data, except that, with respect to data qualifying and submitted as limited rights technical data, the Government shall have the rights specified in the contract modification

implementing the VECF and shall appropriately mark the data. (The terms "unlimited rights" and "limited rights" are defined in Part 27 of the Federal Acquisition Regulation.)

(End of clause)

52.249-2 TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) (MAY 2004) -
ALTERNATE I (SEP 1996)

(a) The Government may terminate performance of work under this contract in whole or, from time to time, in part if the Contracting Officer determines that a termination is in the Government's interest. The Contracting Officer shall terminate by delivering to the Contractor a Notice of Termination specifying the extent of termination and the effective date.

(b) After receipt of a Notice of Termination, and except as directed by the Contracting Officer, the Contractor shall immediately proceed with the following obligations, regardless of any delay in determining or adjusting any amounts due under this clause:

(1) Stop work as specified in the notice.

(2) Place no further subcontracts or orders (referred to as subcontracts in this clause) for materials, services, or facilities, except as necessary to complete the continued portion of the contract.

(3) Terminate all subcontracts to the extent they relate to the work terminated.

(4) Assign to the Government, as directed by the Contracting Officer, all right, title, and interest of the Contractor under the subcontracts terminated, in which case the Government shall have the right to settle or to pay any termination settlement proposal arising out of those terminations.

(5) With approval or ratification to the extent required by the Contracting Officer, settle all outstanding liabilities and termination settlement proposals arising from the termination of subcontracts; the approval or ratification will be final for purposes of this clause.

(6) As directed by the Contracting Officer, transfer title and deliver to the Government (i) the fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced or acquired for the work terminated, and (ii) the completed or partially completed plans, drawings, information, and other property that, if the contract had been completed, would be required to be furnished to the Government.

(7) Complete performance of the work not terminated.

(8) Take any action that may be necessary, or that the Contracting Officer may direct, for the protection and preservation of the property related to this contract that is in the possession of the Contractor and in which the Government has or may acquire an interest.

(9) Use its best efforts to sell, as directed or authorized by the Contracting Officer, any property of the types referred to in subparagraph (b)(6) of this clause; provided, however, that the Contractor (i) is not required to extend credit to any purchaser and (ii) may acquire the property under the conditions prescribed by, and at prices approved by, the Contracting Officer. The proceeds of any transfer or disposition will be applied to reduce any payments to be made by the Government under this contract, credited to the price or cost of the work, or paid in any other manner directed by the Contracting Officer.

(c) The Contractor shall submit complete termination inventory schedules no later than 120 days from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 120-day period.

(d) After expiration of the plant clearance period as defined in Subpart 49.001 of the Federal Acquisition Regulation, the Contractor may submit to the Contracting Officer a list, certified as to quantity and quality, of termination inventory not previously disposed of, excluding items authorized for disposition by the Contracting Officer. The Contractor may request the Government to remove those items or enter into an agreement for their storage. Within 15 days, the Government will accept title to those items and remove them or enter into a storage agreement. The Contracting Officer may verify the list upon removal of the items, or if stored, within 45 days from submission of the list, and shall correct the list, as necessary, before final settlement.

(e) After termination, the Contractor shall submit a final termination settlement proposal to the Contracting Officer in the form and with the certification prescribed by the Contracting Officer. The Contractor shall submit the proposal promptly, but no later than 1 year from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 1-year period. However, if the Contracting Officer determines that the facts justify it, a termination settlement proposal may be received and acted on after 1 year or any extension. If the Contractor fails to submit the proposal within the time allowed, the Contracting Officer may determine, on the basis of information available, the amount, if any, due the Contractor because of the termination and shall pay the amount determined.

(f) Subject to paragraph (e) of this clause, the Contractor and the Contracting Officer may agree upon the whole or any part of the amount to be paid or remaining to be paid because of the termination. The amount may include a reasonable allowance for profit on work done. However, the agreed amount, whether under this paragraph (g) or paragraph (g) of this clause, exclusive of costs shown in subparagraph (g)(3) of this clause, may not exceed the total contract price as reduced by (1) the amount of payments previously made and (2) the contract price of work not terminated. The contract shall be modified, and the Contractor paid the agreed amount. Paragraph (g) of this clause shall not limit, restrict, or affect the amount that may be agreed upon to be paid under this paragraph.

(g) If the Contractor and Contracting Officer fail to agree on the whole amount to be paid the Contractor because of the termination of work, the Contracting Officer shall pay the Contractor the amounts determined as follows, but without duplication of any amounts agreed upon under paragraph (f) of this clause:

(1) For contract work performed before the effective date of termination, the total (without duplication of any items) of--

(i) The cost of this work;

(ii) The cost of settling and paying termination settlement proposals under terminated subcontracts that are properly chargeable to the terminated portion of the contract if not included in subdivision (g)(1)(i) of this clause; and

(iii) A sum, as profit on subdivision (g)(1)(i) of this clause, determined by the Contracting Officer under 49.202 of the Federal Acquisition Regulation, in effect on the date of this contract, to be fair and reasonable; however, if it appears that the Contractor would have sustained a loss on the entire contract had it been completed, the Contracting Officer shall allow no profit under this subdivision (iii) and shall reduce the settlement to reflect the indicated rate of loss.

(2) The reasonable costs of settlement of the work terminated, including--

(i) Accounting, legal, clerical, and other expenses reasonably necessary for the preparation of termination settlement proposals and supporting data;

(ii) The termination and settlement of subcontracts (excluding the amounts of such settlements); and

(iii) Storage, transportation, and other costs incurred, reasonably necessary for the preservation, protection, or disposition of the termination inventory.

(h) Except for normal spoilage, and except to the extent that the Government expressly assumed the risk of loss, the Contracting Officer shall exclude from the amounts payable to the Contractor under paragraph (g) of this clause, the fair value, as determined by the Contracting Officer, of property that is destroyed, lost, stolen, or damaged so as to become undeliverable to the Government or to a buyer.

(i) The cost principles and procedures of Part 31 of the Federal Acquisition Regulation, in effect on the date of this contract, shall govern all costs claimed, agreed to, or determined under this clause.

(j) The Contractor shall have the right of appeal, under the Disputes clause, from any determination made by the Contracting Officer under paragraph (e), (g), or (l) of this clause, except that if the Contractor failed to submit the termination settlement proposal or request for equitable adjustment within the time provided in paragraph (e) or (l), respectively, and failed to request a time extension, there is no right of appeal.

(k) In arriving at the amount due the Contractor under this clause, there shall be deducted--

(1) All unliquidated advance or other payments to the Contractor under the terminated portion of this contract;

(2) Any claim which the Government has against the Contractor under this contract; and

(3) The agreed price for, or the proceeds of sale of, materials, supplies, or other things acquired by the Contractor or sold under the provisions of this clause and not recovered by or credited to the Government.

(l) If the termination is partial, the Contractor may file a proposal with the Contracting Officer for an equitable adjustment of the price(s) of the continued portion of the contract. The Contracting Officer shall make any equitable adjustment agreed upon. Any proposal by the Contractor for an equitable adjustment under this clause shall be requested within 90 days from the effective date of termination unless extended in writing by the Contracting Officer.

(m)(1) The Government may, under the terms and conditions it prescribes, make partial payments and payments against costs incurred by the Contractor for the terminated portion of the contract, if the Contracting Officer believes the total of these payments will not exceed the amount to which the Contractor will be entitled.

(2) If the total payments exceed the amount finally determined to be due, the Contractor shall repay the excess to the Government upon demand, together with interest computed at the rate established by the Secretary of the Treasury under 50 U.S.C. App. 1215(b)(2). Interest shall be computed for the period from the date the excess payment is received by the Contractor to the date the excess is repaid. Interest shall not be charged on any excess payment due to a reduction in the Contractor's termination settlement proposal because of retention or other disposition of termination inventory until 10 days after the date of the retention or disposition, or a later date determined by the Contracting Officer because of the circumstances.

(n) Unless otherwise provided in this contract or by statute, the Contractor shall maintain all records and documents relating to the terminated portion of this contract for 3 years after final settlement. This includes all books and other evidence bearing on the Contractor's costs and expenses under this contract. The Contractor shall make these records and documents available to the Government, at the Contractor's office, at all reasonable times, without any direct charge. If approved by the Contracting Officer, photographs, microphotographs, or other authentic reproductions may be maintained instead of original records and documents.

(End of clause)

52.249-10 DEFAULT (FIXED-PRICE CONSTRUCTION) (APR 1984)

(a) If the Contractor refuses or fails to prosecute the work or any separable part, with the diligence that will insure its completion within the time specified in this contract including any extension, or fails to complete the work within this time, the Government may, by written notice to the Contractor, terminate the right to proceed with the work (or the separable part of the work) that has been delayed. In this event, the Government may take over the work and complete it by contract or otherwise, and may take possession of and use any materials, appliances, and plant on the work site necessary for completing the work. The Contractor and its sureties shall be liable for any damage to the Government resulting from the Contractor's refusal or failure to complete the work within the specified time, whether or not the Contractor's right to proceed with the work is terminated. This liability includes any increased costs incurred by the Government in completing the work.

(b) The Contractor's right to proceed shall not be terminated nor the Contractor charged with damages under this clause, if--

(1) The delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such causes include

(i) acts of God or of the public enemy,

(ii) acts of the Government in either its sovereign or contractual capacity,

(iii) acts of another Contractor in the performance of a contract with the Government,

(iv) fires,

(v) floods,

(vi) epidemics,

(vii) quarantine restrictions,

(viii) strikes,

(ix) freight embargoes,

(x) unusually severe weather, or delays of subcontractors or suppliers at any tier arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and the subcontractors or suppliers; and

(2) The Contractor, within 10 days from the beginning of any delay (unless extended by the Contracting Officer), notifies the Contracting Officer in writing of the causes of delay. The Contracting Officer shall ascertain the facts and the extent of delay. If, in the judgment of the Contracting Officer, the findings of fact warrant such action, the time for completing the work shall be extended. The findings of the Contracting Officer shall be final and conclusive on the parties, but subject to appeal under the Disputes clause.

(c) If, after termination of the Contractor's right to proceed, it is determined that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the termination had been issued for the convenience of the Government.

The rights and remedies of the Government in this clause are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

52.253-1 COMPUTER GENERATED FORMS (JAN 1991)

(a) Any data required to be submitted on a Standard or Optional Form prescribed by the Federal Acquisition Regulation (FAR) may be submitted on a computer generated version of the form, provided there is no change to the name, content, or sequence of the data elements on the form, and provided the form carries the Standard or Optional Form number and edition date.

(b) Unless prohibited by agency regulations, any data required to be submitted on an agency unique form prescribed by an agency supplement to the FAR may be submitted on a computer generated version of the form provided there is no change to the name, content, or sequence of the data elements on the form and provided the form carries the agency form number and edition date.

(g) If the Contractor submits a computer generated version of a form that is different than the required form, then the rights and obligations of the parties will be determined based on the content of the required form.

(End of clause)

252.201-7000 CONTRACTING OFFICER'S REPRESENTATIVE (DEC 1991)

(a) "Definition. Contracting officer's representative" means an individual designated in accordance with subsection 201.602-2 of the Defense Federal Acquisition Regulation Supplement and authorized in writing by the contracting officer to perform specific technical or administrative functions.

(b) If the Contracting Officer designates a contracting officer's representative (COR), the Contractor will receive a copy of the written designation. It will specify the extent of the COR's authority to act on behalf of the contracting officer. The COR is not authorized to make any commitments or changes that will affect price, quality, quantity, delivery, or any other term or condition of the contract.

(End of clause)

252.203-7001 PROHIBITION ON PERSONS CONVICTED OF FRAUD OR OTHER DEFENSE-CONTRACT-RELATED FELONIES (DEC 2004)

(a) Definitions. As used in this clause—

(1) "Arising out of a contract with the DoD" means any act in connection with—

(i) Attempting to obtain;

(ii) Obtaining, or

(iii) Performing a contract or first-tier subcontract of any agency, department, or component of the Department of Defense (DoD).

(2) "Conviction of fraud or any other felony" means any conviction for fraud or a felony in violation of state or Federal criminal statutes, whether entered on a verdict or plea, including a plea of *nolo contendere*, for which sentence has been imposed.

(3) "Date of conviction" means the date judgment was entered against the individual.

(b) Any individual who is convicted after September 29, 1988, of fraud or any other felony arising out of a contract with the DoD is prohibited from serving--

(1) In a management or supervisory capacity on this contract;

(2) On the board of directors of the Contractor;

(3) As a consultant, agent, or representative for the Contractor; or

(4) In any other capacity with the authority to influence, advise, or control the decisions of the Contractor with regard to this contract.

(c) Unless waived, the prohibition in paragraph (b) of this clause applies for not less than 5 years from the date of conviction.

(d) 10 U.S.C. 2408 provides that the Contractor shall be subject to a criminal penalty of not more than \$500,000 if convicted of knowingly--

(1) Employing a person under a prohibition specified in paragraph (b) of this clause; or

(2) Allowing such a person to serve on the board of directors of the contractor or first-tier subcontractor.

(e) In addition to the criminal penalties contained in 10 U.S.C. 2408, the Government may consider other available remedies, such as—

(1) Suspension or debarment;

(2) Cancellation of the contract at no cost to the Government; or

(3) Termination of the contract for default.

(f) The Contractor may submit written requests for waiver of the prohibition in paragraph (b) of this clause to the Contracting Officer. Requests shall clearly identify—

(1) The person involved;

(2) The nature of the conviction and resultant sentence or punishment imposed;

(3) The reasons for the requested waiver; and

(4) An explanation of why a waiver is in the interest of national security.

(g) The Contractor agrees to include the substance of this clause, appropriately modified to reflect the identity and relationship of the parties, in all first-tier subcontracts exceeding the simplified acquisition threshold in Part 2 of the Federal Acquisition Regulation, except those for commercial items or components.

(h) Pursuant to 10 U.S.C. 2408(c), defense contractors and subcontractors may obtain information as to whether a particular person has been convicted of fraud or any other felony arising out of a contract with the DoD by contacting The Office of Justice Programs, The Denial of Federal Benefits Office, U.S. Department of Justice, telephone (301) 809-4904.

(End of clause)

252.203-7002 DISPLAY OF DOD HOTLINE POSTER (DEC 1991)

(a) The Contractor shall display prominently in common work areas within business segments performing work under Department of Defense (DoD) contracts, DoD Hotline Posters prepared by the DoD Office of the Inspector General.

(b) DoD Hotline Posters may be obtained from the DoD Inspector General, ATTN: Defense Hotline, 400 Army Navy Drive, Washington, DC 22202-2884.

(h) The Contractor need not comply with paragraph (a) of this clause if it has established a mechanism, such as a hotline, by which employees may report suspected instances of improper conduct, and instructions that encourage employees to make such reports.

(End of clause)

252.204-7000 DISCLOSURE OF INFORMATION (DEC 1991)

(a) The Contractor shall not release to anyone outside the Contractor's organization any unclassified information, regardless of medium (e.g., film, tape, document), pertaining to any part of this contract or any program related to this contract, unless--

(1) The Contracting Officer has given prior written approval; or

(2) The information is otherwise in the public domain before the date of release.

(b) Requests for approval shall identify the specific information to be released, the medium to be used, and the purpose for the release. The Contractor shall submit its request to the Contracting Officer at least 45 days before the proposed date for release.

(c) The Contractor agrees to include a similar requirement in each subcontract under this contract. Subcontractors shall submit requests for authorization to release through the prime contractor to the Contracting Officer.

(End of clause)

252.204-7003 CONTROL OF GOVERNMENT PERSONNEL WORK PRODUCT (APR 1992)

The Contractor's procedures for protecting against unauthorized disclosure of information shall not require Department of Defense employees or members of the Armed Forces to relinquish control of their work products, whether classified or not, to the contractor.

(End of clause)

252.204-7004 REQUIRED CENTRAL CONTRACTOR REGISTRATION (52.204-7) ALTERNATE A (NOV 2003)

(a) Definitions. As used in this clause--

“Central Contractor Registration (CCR) database” means the primary Government repository for contractor information required for the conduct of business with the Government.

“Commercial and Government Entity (CAGE) code” means--

(1) A code assigned by the Defense Logistics Information Service (DLIS) to identify a commercial or Government entity; or

(2) A code assigned by a member of the North Atlantic Treaty Organization that DLIS records and maintains in the CAGE master file. This type of code is known as an “NCAGE code.”

“Data Universal Numbering System (DUNS) number” means the 9-digit number assigned by Dun and Bradstreet, Inc. (D&B) to identify unique business entities.

“Data Universal Numbering System +4 (DUNS+4) number” means the DUNS number assigned by D&B plus a 4-character suffix that may be assigned by a business concern. (D&B has no affiliation with this 4-character suffix.) This 4-character suffix may be assigned at the discretion of the business concern to establish additional CCR records for identifying alternative Electronic Funds Transfer (EFT) accounts (see Subpart 32.11 of the Federal Acquisition Regulation) for the same parent concern.

“Registered in the CCR database” means that--

(1) The Contractor has entered all mandatory information, including the DUNS number or the DUNS+4 number, into the CCR database;

(2) The Contractor's CAGE code is in the CCR database; and

(3) The Government has validated all mandatory data fields and has marked the records “Active.”

(b)(1) By submission of an offer, the offeror acknowledges the requirement that a prospective awardee shall be registered in the CCR database prior to award, during performance, and through final payment of any contract, basic agreement, basic ordering agreement, or blanket purchasing agreement resulting from this solicitation.

(2) The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation "DUNS" or "DUNS +4" followed by the DUNS or DUNS +4 number that identifies the offeror's name and address exactly as stated in the offer. The DUNS number will be used by the Contracting Officer to verify that the offeror is registered in the CCR database.

(c) If the offeror does not have a DUNS number, it should contact Dun and Bradstreet directly to obtain one.

(1) An offeror may obtain a DUNS number-

(i) If located within the United States, by calling Dun and Bradstreet at 1-866-705-5711 or via the Internet at <http://www.dnb.com>; or

(ii) If located outside the United States, by contacting the local Dun and Bradstreet office.

(2) The offeror should be prepared to provide the following information:

(i) Company legal business.

(ii) Tradestyle, doing business, or other name by which your entity is commonly recognized.

(iii) Company Physical Street Address, City, State, and Zip Code.

(iv) Company Mailing Address, City, State and Zip Code (if separate from physical).

(v) Company Telephone Number.

(vi) Date the company was started.

(vii) Number of employees at your location.

(viii) Chief executive officer/key manager.

(ix) Line of business (industry).

(x) Company Headquarters name and address (reporting relationship within your entity).

(d) If the Offeror does not become registered in the CCR database in the time prescribed by the Contracting Officer, the Contracting Officer will proceed to award to the next otherwise successful registered Offeror.

(e) Processing time, which normally takes 48 hours, should be taken into consideration when registering. Offerors who are not registered should consider applying for registration immediately upon receipt of this solicitation.

(f) The Contractor is responsible for the accuracy and completeness of the data within the CCR database, and for any liability resulting from the Government's reliance on inaccurate or incomplete data. To remain registered in the CCR database after the initial registration, the Contractor is required to review and update on an annual basis from the date of initial registration or subsequent updates its information in the CCR database to ensure it is current, accurate and complete. Updating information in the CCR does not alter the terms and conditions of this contract and is not a substitute for a properly executed contractual document.

(g)

(1)

(i) If a Contractor has legally changed its business name, "doing business as" name, or division name (whichever is shown on the contract), or has transferred the assets used in performing the contract, but has not completed the necessary requirements regarding novation and change-of-name agreements in Subpart 42.12, the Contractor shall provide the responsible Contracting Officer a minimum of one business day's written notification of its intention to (A) change the name in the CCR database; (B) comply with the requirements of Subpart 42.12 of the FAR; and (C) agree in writing to the timeline and procedures specified by the responsible Contracting Officer. The Contractor must provide with the notification sufficient documentation to support the legally changed name.

(ii) If the Contractor fails to comply with the requirements of paragraph (g)(1)(i) of this clause, or fails to perform the agreement at paragraph (g)(1)(i)(C) of this clause, and, in the absence of a properly executed novation or change-of-name agreement, the CCR information that shows the Contractor to be other than the

Contractor indicated in the contract will be considered to be incorrect information within the meaning of the "Suspension of Payment" paragraph of the electronic funds transfer (EFT) clause of this contract.

(2) The Contractor shall not change the name or address for EFT payments or manual payments, as appropriate, in the CCR record to reflect an assignee for the purpose of assignment of claims (see FAR Subpart 32.8, Assignment of Claims). Assignees shall be separately registered in the CCR database. Information provided to the Contractor's CCR record that indicates payments, including those made by EFT, to an ultimate recipient other than that Contractor will be considered to be incorrect information within the meaning of the "Suspension of payment" paragraph of the EFT clause of this contract.

(h) Offerors and Contractors may obtain information on registration and annual confirmation requirements via the internet at <http://www.ccr.gov> or by calling 1-888-227-2423, or 269-961-5757.

(End of clause)

252.205-7000 PROVISION OF INFORMATION TO COOPERATIVE AGREEMENT HOLDERS (DEC 1991)

(a) Definition.

"Cooperative agreement holder" means a State or local government; a private, nonprofit organization; a tribal organization (as defined in section 4(c) of the Indian Self-Determination and Education Assistance Act (Pub. L. 93-268; 25 U.S.C. 450 (c))); or an economic enterprise (as defined in section 3(e) of the Indian Financing Act of 1974 (Pub. L. 93-362; 25 U.S.C. 1452(e))) whether such economic enterprise is organized for profit or nonprofit purposes; which has an agreement with the Defense Logistics Agency to furnish procurement technical assistance to business entities.

(b) The Contractor shall provide cooperative agreement holders, upon their request, with a list of those appropriate employees or offices responsible for entering into subcontracts under defense contracts. The list shall include the business address, telephone number, and area of responsibility of each employee or office.

(c) The Contractor need not provide the listing to a particular cooperative agreement holder more frequently than once a year.

(End of clause)

252.209-7001 DISCLOSURE OF OWNERSHIP OR CONTROL BY THE GOVERNMENT OF A TERRORIST COUNTRY (SEP 2004)

(a) "Definitions."

As used in this provision --

(a) "Government of a terrorist country" includes the state and the government of a terrorist country, as well as any political subdivision, agency, or instrumentality thereof.

(2) "Terrorist country" means a country determined by the Secretary of State, under section 6(j)(1)(A) of the Export Administration Act of 1979 (50 U.S.C. App. 2405(j)(i)(A)), to be a country the government of which has repeatedly provided support for such acts of international terrorism. As of the date of this provision, terrorist countries subject

to this provision include: Cuba, Iran, Libya, North Korea, Sudan, and Syria.

(3) "Significant interest" means --

(i) Ownership of or beneficial interest in 5 percent or more of the firm's or subsidiary's securities. Beneficial interest includes holding 5 percent or more of any class of the firm's securities in "nominee shares," "street names," or some other method of holding securities that does not disclose the beneficial owner;

(ii) Holding a management position in the firm, such as a director or officer;

(iii) Ability to control or influence the election, appointment, or tenure of directors or officers in the firm;

(iv) Ownership of 10 percent or more of the assets of a firm such as equipment, buildings, real estate, or other tangible assets of the firm; or

(v) Holding 50 percent or more of the indebtedness of a firm.

(b) "Prohibition on award."

In accordance with 10 U.S.C. 2327, no contract may be awarded to a firm or a subsidiary of a firm if the government of a terrorist country has a significant interest in the firm or subsidiary or, in the case of a subsidiary, the firm that owns the subsidiary, unless a waiver is granted by the Secretary of Defense.

(c) "Disclosure."

If the government of a terrorist country has a significant interest in the Offeror or a subsidiary of the Offeror, the Offeror shall disclose such interest in an attachment to its offer. If the Offeror is a subsidiary, it shall also disclose any significant interest the government of a terrorist country has in any firm that owns or controls the subsidiary. The disclosure shall include --

(1) Identification of each government holding a significant interest; and

(2) A description of the significant interest held by each government.

(End of provision)

252.209-7004 SUBCONTRACTING WITH FIRMS THAT ARE OWNED OR CONTROLLED BY THE GOVERNMENT OF A TERRORIST COUNTRY (MAR 1998)

(a) Unless the Government determines that there is a compelling reason to do so, the Contractor shall not enter into any subcontract in excess of \$25,000 with a firm, or subsidiary of a firm, that is identified, on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs, as being ineligible for the award of Defense contracts or subcontracts because it is owned or controlled by the government of a terrorist country.

(b) A corporate officer or a designee of the Contractor shall notify the Contracting Officer, in writing, before entering into a subcontract with a party that is identified, on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs, as being ineligible for the award of Defense contracts or subcontracts because it is owned or controlled by the government of a terrorist country. The notice must include the name of the proposed subcontractor notwithstanding its inclusion on the List of Parties Excluded From Federal Procurement and Nonprocurement Programs.

(End of clause)

252.215-7000 PRICING ADJUSTMENTS (DEC 1991)

The term "pricing adjustment," as used in paragraph (a) of the clauses entitled "Price Reduction for Defective Cost or Pricing Data - Modifications," "Subcontractor Cost or Pricing Data," and "Subcontractor Cost or Pricing Data - Modifications," means the aggregate increases and/or decreases in cost plus applicable profits.

(End of clause)

252.219-7003 SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING PLAN (DOD CONTRACTS) (APR. 1996)

This clause supplements the Federal Acquisition Regulation 52.219-9, Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan, clause of this contract.

(a) *Definitions. Historically black colleges and universities*, as used in this clause, means institutions determined by the Secretary of Education to meet the requirements of 34 CFR 608.2. The term also means any nonprofit research institution that was an integral part of such a college or university before November 14, 1986.

Minority institutions, as used in this clause, means institutions meeting the requirements of section 1046(3) of the Higher Education Act of 1965 (20 U.S.C. 1135d-5(3)). The term also includes Hispanic-serving institutions as defined in section 316(b)(1) of such Act (20 U.S.C. 1059c(b)(1)).

(b) Except for company or division-wide commercial items subcontracting plans, the term *small disadvantaged business*, when used in the FAR 52.219-9 clause, includes historically black colleges and universities and minority institutions, in addition to small disadvantaged business concerns.

(c) Work under the contract or its subcontracts shall be credited toward meeting the small disadvantaged business concern goal required by paragraph (d) of the FAR 52.219-9 clause when:

(1) It is performed on Indian lands or in joint venture with an Indian tribe or a tribally-owned corporation, and

(2) It meets the requirements of 10 U.S.C. 2323a.

(d) Subcontracts awarded to workshops approved by the Committee for Purchase from People Who are Blind or Severely Disabled (41 U.S.C. 46-48), may be counted toward the Contractor's small business subcontracting goal.

(e) A mentor firm, under the Pilot Mentor-Protege Program established under Section 831 of Pub. L. 101-510, as amended, may count toward its small disadvantaged business goal, subcontracts awarded--

(f) The master plan approval referred to in paragraph (f) of the FAR 52.219-9 clause is approval by the Contractor's cognizant contract administration activity.

(g) In those subcontracting plans which specifically identify small, small disadvantaged, and women-owned small businesses, the Contractor shall notify the Administrative Contracting Officer of any substitutions of firms that are not small, small disadvantaged, or women-owned small businesses for the firms listed in the subcontracting plan. Notifications shall be in writing and shall occur within a reasonable period of time after award of the subcontract. Contractor-specified formats shall be acceptable.

(End of clause)

252.223-7006 PROHIBITION ON STORAGE AND DISPOSAL OF TOXIC AND HAZARDOUS MATERIALS (APR 1993)

(a) "Definitions".

As used in this clause --

(1) "Storage" means a non-transitory, semi-permanent or permanent holding, placement, or leaving of material. It does not include a temporary accumulation of a limited quantity of a material used in or a waste generated or resulting from authorized activities, such as servicing, maintenance, or repair of Department of Defense (DoD) items, equipment, or facilities.

(2) "Toxic or hazardous materials" means:

(i) Materials referred to in section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 U.S.C. 9601(14)) and materials designated under section 102 of CERCLA (42 U.S.C. 9602) (40 CFR part 302);

(ii) Materials that are of an explosive, flammable, or pyrotechnic nature; or

(iii) Materials otherwise identified by the Secretary of Defense as specified in DoD regulations.

(b) In accordance with 10 U.S.C. 2692, the Contractor is prohibited from storing or disposing of non-DoD-owned toxic or hazardous materials on a DoD installation, except to the extent authorized by a statutory exception to 10 U.S.C. 2692 or as authorized by the Secretary of Defense or his designee.

(End of clause)

252.225-7031 SECONDARY ARAB BOYCOTT OF ISRAEL (APR 2003)

(a) Definitions. As used in this provision--

(1) Foreign person means any person (including any individual, partnership, corporation, or other form of association) other than a United States person.

(2) United States person is defined in 50 U.S.C. App. 2415(2) and means--

(i) Any United States resident or national (other than an individual resident outside the United States who is employed by other than a United States person);

(ii) Any domestic concern (including any permanent domestic establishment of any foreign concern); and

(iii) Any foreign subsidiary or affiliate (including any permanent foreign establishment) of any domestic concern that is controlled in fact by such domestic concern.

(b) Certification. If the offeror is a foreign person, the offeror certifies, by submission of an offer, that it--

(1) Does not comply with the Secondary Arab Boycott of Israel; and

(2) Is not taking or knowingly agreeing to take any action, with respect to the Secondary Boycott of Israel by Arab countries, which 50 U.S.C. App. 2407(a) prohibits a United States person from taking.

(End of provision)

252.226-7001 UTILIZATION OF INDIAN ORGANIZATIONS AND INDIAN-OWNED ECONOMIC ENTERPRISES, AND NATIVE HAWAIIAN SMALL BUSINESS CONCERNS (SEP 2004)

(a) Definitions. As used in this clause--

Indian means--

(1) Any person who is a member of any Indian tribe, band, group, pueblo, or community that is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs (BIA) in accordance with 25 U.S.C. 1452(c); and

(2) Any "Native" as defined in the Alaska Native Claims Settlement Act (43 U.S.C. 1601 et seq.).

Indian organization means the governing body of any Indian tribe or entity established or recognized by the governing body of an Indian tribe for the purposes of 25 U.S.C. chapter 17.

Indian-owned economic enterprise means any Indian-owned (as determined by the Secretary of the Interior) commercial, industrial, or business activity established or organized for the purpose of profit, provided that Indian ownership constitutes not less than 51 percent of the enterprise.

Indian tribe means any Indian tribe, band, group, pueblo, or community, including native villages and native groups (including corporations organized by Kenai, Juneau, Sitka, and Kodiak) as defined in the Alaska Native Claims Settlement Act, that is recognized by the Federal Government as eligible for services from BIA in accordance with 25 U.S.C. 1452(c).

Interested party means a contractor or an actual or prospective offeror whose direct economic interest would be affected by the award of a subcontract or by the failure to award a subcontract.

Native Hawaiian small business concern means an entity that is --

(1) A small business concern as defined in section 3 of the Small Business Act (15 U.S.C. 632) and relevant implementing regulations; and

(2) Owned and controlled by a Native Hawaiian as defined in 25 U.S.C. 4221(9).

(b) The Contractor shall use its best efforts to give Indian organizations, Indian-owned economic enterprises, and Native Hawaiian small business concerns the maximum practicable opportunity to participate in the subcontracts it awards, to the fullest extent consistent with efficient performance of the contract.

(c) The Contracting Officer and the Contractor, acting in good faith, may rely on the representation of an Indian organization, Indian-owned economic enterprise, or Native Hawaiian small business concern as to its eligibility, unless an interested party challenges its status or the Contracting Officer has independent reason to question that status.

(d) In the event of a challenge to the representation of a subcontractor, the Contracting Officer will refer the matter to--
-

(1) For matters relating to Indian organizations or Indian-owned economic enterprises: U.S. Department of the Interior, Bureau of Indian Affairs, Attn: Chief, Division of Contracting and Grants Administration, 1849 C Street NW, MS-2626-MIB, Washington, DC 20240-4000. The BIA will determine the eligibility and will notify the Contracting Officer.

(2) For matters relating to Native Hawaiian small business concerns: Department of Hawaiian Home Lands, PO Box 1879, Honolulu, HI 96805. The Department of Hawaiian Home Lands will determine the eligibility and will notify the Contracting Officer.

(e) No incentive payment will be made--

(1) While a challenge is pending; or

(2) If a subcontractor is determined to be an ineligible participant.

(f)(1) The Contractor, on its own behalf or on behalf of a subcontractor at any tier, may request an incentive payment in accordance with this clause.

(2) The incentive amount that may be requested is 5 percent of the estimated cost, target cost, or fixed price included in the subcontract at the time of award to the Indian organization, Indian-owned economic enterprise, or Native Hawaiian small business concern.

(3) In the case of a subcontract for commercial items, the Contractor may receive an incentive payment only if the subcontracted items are produced or manufactured in whole or in part by an Indian organization, Indian-owned economic enterprise, or Native Hawaiian small business concern.

(4) The Contractor has the burden of proving the amount claimed and shall assert its request for an incentive payment prior to completion of contract performance.

(5) The Contracting Officer, subject to the terms and conditions of the contract and the availability of funds, will authorize an incentive payment of 5 percent of the estimated cost, target cost, or fixed price included in the subcontract awarded to the Indian organization, Indian-owned economic enterprise, or Native Hawaiian small business concern.

(6) If the Contractor requests and receives an incentive payment on behalf of a subcontractor, the Contractor is obligated to pay the subcontractor the incentive amount.

(g) The Contractor shall insert the substance of this clause, including this paragraph (g), in all subcontracts exceeding \$500,000.

(End of clause)

252.227-7023 DRAWINGS AND OTHER DATA TO BECOME PROPERTY OF GOVERNMENT. (MAR 1979)

All designs, drawings, specifications, notes and other works developed in the performance of this contract shall become the sole property of the Government and may be used on any other design or construction without additional compensation to the Contractor. The Government shall be considered the "person for whom the work was

prepared" for the purpose of authorship in any copyrightable work under 17 U.S.C. 201(b). With respect thereto, the Contractor agrees not to assert or authorize others to assert any rights nor establish any claim under the design patent or copyright laws. The Contractor for a period of three (3) years after completion of the project agrees to furnish all retained works on the request of the Contracting Officer. Unless otherwise provided in this contract, the Contractor shall have the right to retain copies of all works beyond such period.

(End of clause)

252.227-7033 RIGHTS IN SHOP DRAWINGS (APR 1966)

(a) Shop drawings for construction means drawings, submitted to the Government by the Construction Contractor, subcontractor or any lower-tier subcontractor pursuant to a construction contract, showing in detail (i) the proposed fabrication and assembly of structural elements and (ii) the installation (i.e., form, fit, and attachment details) of materials or equipment. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(b) This clause, including this paragraph (b), shall be included in all subcontracts hereunder at any tier.

252.231-7000 SUPPLEMENTAL COST PRINCIPLES (DEC 1991)

When the allowability of costs under this contract is determined in accordance with part 31 of the Federal Acquisition Regulation (FAR), allowability shall also be determined in accordance with part 231 of the Defense FAR Supplement, in effect on the date of this contract.

(End of clause)

252.236-7000 MODIFICATION PROPOSALS - PRICE BREAKDOWN. (DEC 1991)

(a) The Contractor shall furnish a price breakdown, itemized as required and within the time specified by the Contracting Officer, with any proposal for a contract modification.

(b) The price breakdown --

(1) Must include sufficient detail to permit an analysis of profit, and of all costs for --

(i) Material;

(ii) Labor;

(iii) Equipment;

(iv) Subcontracts; and

(v) Overhead; and

(2) Must cover all work involved in the modification, whether the work was deleted, added, or changed.

(c) The Contractor shall provide similar price breakdowns to support any amounts claimed for subcontracts.

(d) The Contractor's proposal shall include a justification for any time extension proposed.

252.242-7000 POSTAWARD CONFERENCE (DEC 1991)

The Contractor agrees to attend any postaward conference convened by the contracting activity or contract administration office in accordance with Federal Acquisition Regulation subpart 42.5.

(End of clause)

252.243-7001 PRICING OF CONTRACT MODIFICATIONS (DEC 1991)

When costs are a factor in any price adjustment under this contract, the contract cost principles and procedures in FAR part 31 and DFARS part 231, in effect on the date of this contract, apply.

252.243-7002 REQUESTS FOR EQUITABLE ADJUSTMENT (MAR 1998)

(a) The amount of any request for equitable adjustment to contract terms shall accurately reflect the contract adjustment for which the Contractor believes the Government is liable. The request shall include only costs for performing the change, and shall not include any costs that already have been reimbursed or that have been separately claimed. All indirect costs included in the request shall be properly allocable to the change in accordance with applicable acquisition regulations.

(b) In accordance with 10 U.S.C. 2410(a), any request for equitable adjustment to contract terms that exceeds the simplified acquisition threshold shall bear, at the time of submission, the following certificate executed by an individual authorized to certify the request on behalf of the Contractor:

I certify that the request is made in good faith, and that the supporting data are accurate and complete to the best of my knowledge and belief.

(Official's Name)

(Title)

(c) The certification in paragraph (b) of this clause requires full disclosure of all relevant facts, including--

(1) Cost or pricing data if required in accordance with subsection 15.403-4 of the Federal Acquisition Regulation (FAR); and

(2) Information other than cost or pricing data, in accordance with subsection 15.403-3 of the FAR, including actual cost data and data to support any estimated costs, even if cost or pricing data are not required.

(d) The certification requirement in paragraph (b) of this clause does not apply to----

(1) Requests for routine contract payments; for example, requests for payment for accepted supplies and services, routine vouchers under a cost-reimbursement type contract, or progress payment invoices; or

(2) Final adjustment under an incentive provision of the contract.

Successor Contracting Officers (52.201-4001)

The Contracting Officer who signed this contract is the primary Contracting Officer for the contract. Nevertheless, any Contracting Officer assigned to the Seattle District and acting within his/her authority may take formal action on this contract when a contract action needs to be taken and the primary Contracting Officer is unavailable.

52.212-4007 ENVIRONMENTAL LITIGATION

(a) If the performance of all or any part of the work is suspended, delayed, or interrupted due to an order of a court of competent jurisdiction as a result of environmental litigation, as defined below, the Contracting Officer, at the request of the Contractor, shall determine whether the order is due in any part to the acts or omissions of the Contractor or a Subcontractor at any tier not required by the terms of this contract. If it is determined that the order is not due in any part to acts or omissions of the Contractor or a Subcontractor at any tier other than as required by the terms of this contract, such suspension, delay, or interruption shall be considered as if ordered by the Contracting Officer in the administration of this contract under the terms of the "Suspension of Work" clause of this contract. The period of such suspension, delay or interruption shall be considered unreasonable, and an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) as provided in that clause, subject to all the provisions thereof.

(b) The term "environmental litigation", as used herein, means a lawsuit alleging that the work will have an adverse effect on the environment or that the Government has not duly considered, either substantially or procedurally, the effect of the work on the environment.

Security Contract Language for all Corps of Engineers' Unclassified Contracts (PIL 2003-06, 19 Feb 03)

All Contractor employees (U.S. citizens and Non-U.S. citizens) working under this contract (*to include grants, cooperative agreements and task orders*) who require access to Automated Information Systems (AIS), (stand alone computers, network computers/systems, e-mail) shall, at a minimum, be designated into an ADP-III position (non-sensitive) in accordance with DoD 5220-22-R, Industrial Security Regulation. The investigative requirements for an ADP-III position are a favorable National Agency Check (NAC), SF-85P, Public Trust Position. The contractor shall have each applicable employee complete a SF-85P and submit to the Seattle District, U.S. Army, Corps of Engineers, PO Box 3755, Seattle, WA 98124-3755, Security Officer within three (3) working days after award of any contract or task order, and shall be submitted prior to the individual being permitted access to an AIS. Contractors that have a commercial or government entity (CAGE) Code and Facility Security Clearance through the Defense Security Service shall process the NACs and forward visit requests/results of NAC to the Seattle District, U.S. Army, Corps of Engineers, PO Box 3755, Seattle, WA 98124-3755, Security Officer. For those contractors that do not have a CAGE Code or Facility Security Clearance, the Seattle District, U.S. Army, Corps of Engineers, PO Box 3755, Seattle, WA 98124-3755, Security Office will process the investigation in coordination with the Contractor and contract employees.

In accordance with Engineering Regulation, ER 380-1-18, Section 4, foreign nationals who work on Corps of Engineers' contracts or task orders shall be approved by the HQUSACE Foreign Disclosure Officer or higher before beginning work on the contract/task order. This regulation includes subcontractor employees. (NOTE: exceptions to the above requirement include foreign nationals who perform janitorial and/or ground maintenance services.) The contractor shall submit to the Division/District Contract Office, the names of all foreign nationals proposed for performance under this contract/task order, along with documentation to verify that he/she was legally admitted into the United States and has authority to work and/or go to school in the US. Such documentation may include a US

passport, Certificate of US citizenship (INS Form N-560 or N-561), Certificate of Naturalization (INS Form N-550 or N-570), foreign passport with I-551 stamp or attached INS Form I-94 indicating employment authorization, Alien Registration Receipt Card with photograph (INS Form I-151 or I-551), Temporary Resident Card (INS Form I-688), Employment Authorization Card (INS Form I-688A), Reentry Permit (INS Form I-327), Refugee Travel Document (INS Form I-571), Employment Authorization Document issued by the INS which contains a photograph (INS Form I-688B).

Classified contracts require the issuance of a DD Form 254 (Department of Defense Contract Security Classification Specification).

(End of Clause)

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05004

Corrosion Control / AGE, Malmstrom AFB, MT

SPECIAL CLAUSES

SC-1. COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984) (FAR 52.211-10):

The contractor shall be required to (a) commence work under this contract within 10 calendar days after the date the contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than 330 calendar days after date of receipt by Contractor of notice to proceed. The time stated for completion shall include final cleanup of the premises.

SC-1.1 Exception to Completion Period(s): In case the Contracting Officer determines that completion of seeding, sodding, and planting, and establishment of same is not feasible within the completion period(s) stated above, the Contractor shall accomplish such work in the first planting period following the contract completion period and shall complete such work as specified, unless other planting periods are directed or approved by the Contracting Officer.

SC-2. LIQUIDATED DAMAGES - CONSTRUCTION (SEP 2000) (FAR 52.211-12):

(a) If the Contractor fails to complete the work within the time specified in the Contract, or any extension, the Contractor shall pay to the Government as liquidated damages, the sum of \$1,343.00 for each day of delay until the work is completed or accepted.

(b) If the Government terminates the Contractor's right to proceed, the resulting damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess cost of repurchase under the Termination clause of the CONTRACT CLAUSES.

(c) Exception to Liquidated Damage: In case the Contracting Officer determines that completion of work stated above in paragraph Exception to Completion Period(s) is not feasible during the completion period(s) stated in SC-1, such work will be exempted from liquidated damages.

SC-3. TIME EXTENSIONS (Sept 2000) (FAR 52.211-13):

Time extensions for contract changes will depend upon the extent, if any, by which the changes cause delay in the completion of the various elements of construction. The change order granting the time extension may provide that the Contract completion date will be extended only for those specific elements related to the changed work and that the remaining contract completion dates for all other portions of the work will not be altered. The change order also may provide an equitable readjustment of liquidated damages under the new completion schedule.

SC-4. DELETED.

SC-5. INSURANCE - WORK ON A GOVERNMENT INSTALLATION (JAN 1997) (FAR 52.228-5):

(a) The Contractor shall, at its own expense, provide and maintain during the entire performance period of this Contract at least the kinds and minimum amounts of insurance required in the Insurance Liability Schedule or elsewhere in the Contract.

(b) Before commencing work under this Contract, the Contractor shall certify to the Contracting Officer in writing that the required insurance has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective:

(1) For such period as the laws of the State in which this Contract is to be performed prescribe;
or

(2) Until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.

(c) The Contractor shall insert the substance of this clause, including this paragraph (c), in subcontracts under this Contract that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the Contract. The Contractor shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Contracting Officer upon request.

SC-5.1. REQUIRED INSURANCE IN ACCORDANCE WITH FAR 28.307-2:

(1) Workers' compensation and employer's liability: Contractors are required to comply with applicable Federal and State workers' compensation and occupational disease statutes. If occupational diseases are not compensable under those statutes, they shall be covered under the employer's liability section of the insurance policy, except when Contract operations are so commingled with a Contractor's commercial operation that it would not be practical to require this coverage. Employer's liability coverage of at least \$100,000 shall be required, except in states with exclusive or monopolistic funds that do not permit workers' compensation to be written by private carriers.

(2) General Liability:

(a) The Contracting Officer shall require bodily injury liability insurance coverage written on the comprehensive form of policy of at least \$500,000 per occurrence.

(b) Property damage liability insurance shall be required only in special circumstances as determined by the agency.

(3) Automobile liability: The Contracting Officer shall require automobile liability insurance written on the comprehensive form of policy. The policy shall provide for bodily injury and property damage liability covering the operation of all automobiles used in connection with performing the Contract. Policies covering automobiles operated in the United States shall provide coverage of at least \$200,000 per person and \$500,000 per occurrence for bodily injury and \$20,000 per occurrence for property damage. The amount of liability coverage on other policies shall be commensurate with any legal requirements of the locality and sufficient to meet normal and customary claims.

(4) Aircraft public and passenger liability: When aircraft are used in connection with performing the Contract, the Contracting Officer shall require aircraft public and passenger liability insurance. Coverage shall be at least \$200,000 per person and \$500,000 per occurrence for bodily injury, other than passenger liability, and \$200,000 per occurrence for property damage. Coverage for passenger liability bodily injury shall be at least \$200,000 multiplied by the number of seats or passengers, whichever is greater.

(5) Environmental Liability: If this contract includes the transport, treatment, storage, or disposal of hazardous material waste the following coverage is required.

The Contractor shall ensure the transporter and disposal facility have liability insurance in effect for claims arising out of the death or bodily injury and property damage from hazardous material/waste transport, treatment, storage and disposal, including vehicle liability and legal defense costs in the amount of \$1,000,000.00 as evidenced by a certificate of insurance for General, Automobile, and Environmental Liability Coverage. Proof of this insurance shall be provided to the Contracting Officer.

SC-7. PERFORMANCE OF WORK BY THE CONTRACTOR (APR 1984) (FAR 52.236-1):

The Contractor shall perform on the site, and with its own organization, work equivalent to at least twenty-five percent (25%) of the total amount of work to be performed under the Contract. The percentage may be reduced by a supplemental agreement to this Contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

SC-8. PHYSICAL DATA (APR 1984) (FAR 52.236-4):

Data and information furnished or referred to below is for the Contractor's information. The Government will not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

(a) Physical Conditions: The indications of physical conditions on the drawings and in the specifications are the result of site investigations by test holes shown on the drawings.

(b) Weather Conditions: Each bidder shall be satisfied before submitting his bid as to the hazards likely to arise from weather conditions. Complete weather records and reports may be obtained from any National Weather Service Office.

(c) Transportation Facilities: Each bidder, before submitting his bid, shall make an investigation of the conditions of existing public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress at the jobsite. The unavailability of transportation facilities or limitations thereon shall not become a basis for claims for damages or extension of time for completion of the work.

(d) Right-of-Way: The right-of-way for the work covered by these specifications will be furnished by the Government, except that the Contractor shall provide right-of-way for ingress and egress across private property where necessary to gain access to the jobsite. The Contractor may use such portions of the land within the right-of-way not otherwise occupied as may be designated by the Contracting Officer.

The Contractor shall, without expense to the Government, and at any time during the progress of the work when space is needed within the right-of-way for any other purposes, promptly vacate and clean up any part of the grounds that have been allotted to, or have been in use by, him when directed to do so by the Contracting Officer. The Contractor shall keep the buildings and grounds in use by him at the site of the work in an orderly and sanitary condition. Should the Contractor require additional working space or lands for material yards, job offices, or other purposes, he shall obtain such additional lands or easements at his expense.

SC-9. DELETED.

SC-10. LAYOUT OF WORK (APR 1984) (FAR 52.236-17):

The Contractor shall lay out its work from Government-established base lines and benchmarks indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through its negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due, or to become due, to the Contractor.

SC-11. RESERVED:

SC-12 DELETED.

SC-13. IDENTIFICATION OF GOVERNMENT-FURNISHED PROPERTY (APR 1984) (FAR 52.245-3):

The Government will furnish to the Contractor the property identified in the schedule to be incorporated or installed into the work or used in performing the contract. The listed property will be furnished to the Contractor at the place designated by the Contracting Officer. The Contractor is required to accept delivery, pay any demurrage or detention charges, and unload and transport the property to the jobsite at its own expense. When the property is delivered, the Contractor shall verify its quantity and condition and acknowledge receipt in writing to the Contracting Officer. The Contractor shall also report in writing to the Contracting Officer within 24 hours of delivery any damage to or shortage of the property as received. All such property shall be installed or incorporated into the work at the expense of the Contractor, unless otherwise indicated in this contract. Delivery site location for Government Furnished Property shall be as directed by the Contracting Officer.

SCHEDULE

<u>QUANTITY</u>	<u>ITEM</u>
1	2-ton hoist
1	Vehicle lift
1	Ventilated work table
1	Bench Grinder
1	Sand blaster

SC-14. EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE (MAR 1995)-
(EFARS 52.231-5000):

(a) This clause does not apply to terminations. See 52.249-5000, Basis for Settlement of Proposals and FAR Part 49.

(b) Allowable cost for construction and marine plant and equipment in sound workable condition owned or controlled and furnished by a contractor or subcontractor at any tier shall be based on actual cost data for each piece of equipment or groups of similar serial and series for which the Government can determine both ownership and operating costs from the contractor's accounting records. When both ownership and operating costs cannot be determined for any piece of equipment or groups of similar serial or series equipment from the contractor's accounting records, costs for that equipment shall be based upon the applicable provisions of EP 1110-1-8, Construction Equipment Ownership and Operating Expense Schedule, Region IV. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the contracting officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retroactive pricing, the schedule in effect at the time the work was performed shall apply.

(c) Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36. Rates for equipment rented from an organization under common control, lease-purchase arrangements, and sale-leaseback arrangements, will be determined using the schedule, except that actual rates will be used for equipment leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees.

(d) When actual equipment costs are proposed and the total amount of the pricing action exceeds the small purchase threshold, the contracting officer shall request the contractor to submit either certified cost or pricing data, or partial/limited data, as appropriate. The data shall be submitted on Standard Form 1411, Contract Pricing Proposal Cover Sheet.

(e) Copies of EP1110-1-8 "Construction Equipment Ownership and Operating Expense Schedule" Volumes 1 through 12 are available in Portable Document Format (PDF) and can be viewed or downloaded at <http://www.usace.army.mil/inet/usace-docs/eng-pamphlets/cecw.htm>. A CD-ROM containing (Volumes 1-12) is available through either the Superintendent of Documents or Government bookstores. For additional information telephone 202-512-2250, or access on the Internet at http://www.access.gpo.gov/su_docs.

SC-15. PAYMENT FOR MATERIALS DELIVERED OFF-SITE (MAR 1995)-(EFARS 52.232-5000):

(a) Pursuant to FAR clause 52.232-5, Payments Under Fixed Priced Construction Contracts, materials delivered to the contractor at locations other than the site of the work may be taken into consideration in making payments if included in payment estimates and if all the conditions of the General Provisions are fulfilled. Payment for items delivered to locations other than the work site will be limited to: (1) materials required by the technical provisions; or (2) materials that have been fabricated to the point where they are identifiable to an item of work required under this contract.

(b) Such payment will be made only after receipt of paid or receipted invoices or invoices with canceled check showing title to the items in the prime contractor and including the value of material and labor incorporated into the item. In addition to petroleum products, payment for materials delivered off-site is limited to the following items: Any other construction material stored offsite may be considered in determining the amount of a progress payment.

SC-16 AND SC-17 DELETED.

SC-18. CONTRACT DRAWINGS AND SPECIFICATIONS (AUG 2000)(DOD FAR SUPP 252.236-7001):

(a) The Government will provide to the Contractor, without charge, one set of contract drawings and specifications, except publications incorporated into the technical provisions by reference, in electronic or paper media as chosen by the Contracting Officer.

(b) The Contractor shall:

- (1) Check all drawings furnished immediately upon receipt.
- (2) Compare all drawings and verify the figures before laying out the work.
- (3) Promptly notify the Contracting Officer of any discrepancies.
- (4) Be responsible for any errors which might have been avoided by complying with this paragraph (b); and
- (5) Reproduce and print contract drawings and specifications as needed.

(c) In general—

- (1) Large scale drawings shall govern small scale drawings; and

(2) The Contractor shall follow figures marked on drawings in preference to scale measurements.

(d) Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or that are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work. The Contractor shall perform such details as if fully and correctly set forth and described in the drawings and specifications.

(e) The work shall conform to the specifications and the contract drawings identified in the index of drawings attached at the end of the Special Clauses.

SC-19 THROUGH SC-21 DELETED.

SC-22. EPA ENERGY STAR:

The Government requires that certain equipment be Energy Star compliant. Initially, the sole Energy Star requirement shall be the self-certification by the bidder that the specified equipment is Energy Star compliant. Within 3 months of the availability of an EPA sanctioned test for Energy Star compliance, the Contractor shall submit all equipment upgrades and additions for testing and provide proof of compliance to the Government upon completion of testing. Testing shall be at the Contractor's expense.

SC-23. RECOVERED MATERIALS:

The Corps of Engineers encourages all bidders to utilize recovered materials to the maximum extent practicable. The attached APPENDIX R contains procurement guidelines for products containing recovered materials.

SC-24 DELETED.

APPENDIX R

PART 247 - COMPREHENSIVE PROCUREMENT GUIDELINE FOR PRODUCTS CONTAINING RECOVERED MATERIALS

40 CFR Ch. 1 (9-1-99 Edition)

Subpart B-Item Designations

§ 247.10 Paper and paper products.

Paper and paper products, excluding building and construction paper grades.

§ 247.11 Vehicular products.

1. Lubricating oils containing re-refined oil, including engine lubricating oils, hydraulic fluids, and gear oils, excluding marine and aviation oils.
2. Tires, excluding airplane tire
3. Reclaimed engine coolants, excluding coolants used in non-vehicular applications.

247.12 Construction products.

1. Building insulation product including the following items:
2. Loose-fill insulation, including but not limited to cellulose fiber, mineral fibers (fiberglass and rock vermiculite, and perlite;
3. Blanket and batt insulation, including but not limited to mineral fibers (fiberglass and rock wool).
4. Board (sheathing, roof decking wall panel) insulation, including but not limited to structural fiberboard and laminated paperboard products perlite composite board, polyurethane, polyisocyanurate, polystyrene, phenolics, and composites; and
5. Spray-in-place insulation, including but not limited to foam-in-place polyurethane and polyisocyanurate and spray-on cellulose.
6. Structural fiberboard and laminated paperboard products for applications other than building insulation, including building board, sheathing shingle backer, sound deadening board, roof insulating board, insulating wallboard, acoustical and non-acoustical ceiling tile, acoustical and non-acoustical lay-in panels, floor underlayments, and roof overlay (cover board).
7. Cement and concrete, including concrete products such as pipe and block, containing coal fly as ground granulated blast furnace (GGBF) slag.
8. Carpet made of polyester fiber use in low- and medium-wear applications.
9. Floor tiles and patio block containing recovered rubber or plastic.
10. Shower and restroom dividers/partitions containing recovered plastic or steel.
11. Consolidated latex paint used for covering graffiti; and
12. Reprocessed latex paint used for interior and exterior architectural applications such as wallboard, ceilings, and trim; gutter boards; and concrete, stucco, masonry, wood and metal surfaces.

§247.13 Transportation products.

1. Traffic barricades and traffic cones used in controlling or restricting vehicular traffic.
2. Parking stops made from concrete or containing recovered plastic or rubber.

3. Channelizers containing recovered plastic or rubber.
4. Delineators containing recovered plastic, rubber, or steel.
5. Flexible delineators containing recovered plastic.

§ 247.14 Park and recreation products

1. Playground surfaces and running tracks containing recovered rubber or plastic.
2. Plastic fencing containing recovered plastic for use in controlling snow or sand drifting and as a warning/safety barrier in construction or other applications.

247.15 Landscaping products.

1. Hydraulic mulch products containing recovered paper or recovered wood used for hydroseeding and as an over-spray for straw mulch in landscaping, erosion control, and soil reclamation.
2. Compost made from yard trimmings, leaves, and/or grass clippings for use in landscaping, seeding of grass or other plants on roadsides and embankments, as a nutritious mulch under trees and shrubs, and in erosion control and soil reclamation.
3. Garden and soaker hoses containing recovered plastic or rubber.
4. Lawn and garden edging containing recovered plastic or rubber.

§ 247.16 Non-paper office product.

1. Office recycling containers and office waste receptacles.
2. Plastic desktop accessories.
3. Toner cartridges.
4. Binders.
5. Plastic trash bags.
6. Printer ribbons.
7. Plastic envelopes.

§ 247.17 Miscellaneous products.

Pallets containing recovered wood, plastic, or paperboard.

INDEX OF DRAWINGS

CORROSION CONTROL / AGE FACILITY

MALMSTROM AFB, MONTANA

Project Number NZAS 01-3001

Drawing File No. 225s/211-90-09

SHEET NUMBER	PLATE NUMBER	TITLE	REV. NO.	DATE
1	G1.1	Cover Sheet / Sheet Index		7 JAN 05
2	C0.1	Demolition Plan		7 JAN 05
3	C1.1	Site Grading Plan		7 JAN 05
4	C1.2	Site Layout		7 JAN 05
5	C1.3	Site Utilities		7 JAN 05
6	C1.4	Site Details		7 JAN 05
7	C1.5	Site Details		7 JAN 05
8	C1.6	Site Details		7 JAN 05
9	C1.7	Site Details		7 JAN 05
10	C1.8	Manual Cable Barrier		7 JAN 05
11	L1.1	Irrigation Plan		7 JAN 05
12	L1.2	Irrigation Details		7 JAN 05
13	L2.1	Planting Plan		7 JAN 05
14	L2.2	Planting Details		7 JAN 05
15	F1.1	Fire Plan		7 JAN 05
16	EQ1.1	Equipment Plan/Abbreviations		7 JAN 05
17	A1.1	Floor Plan		7 JAN 05
18	A1.2	Roof Plan		7 JAN 05
19	A1.3	Details		7 JAN 05
20	A1.4	Details		7 JAN 05
21	A2.1	Exterior Elevations		7 JAN 05
22	A3.1	Building Sections		7 JAN 05
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27	A6.1	Door Schedule / Elevations and Details		7 JAN 05
28	A6.2	Window Elevations and Details & Stair Section/Details		7 JAN 05
29	A7.1	Enlarged Floor Plan / Interior Elevations		7 JAN 05
30	A7.1	Enlarged Floor Plan / Interior Elevations		7 JAN 05
31	A9.1	Reflected Ceiling Plan		7 JAN 05
32	S0.1	Structural General Notes		7 JAN 05

SHEET NUMBER	PLATE NUMBER	TITLE	REV. NO.	DATE
33	S1.1	Foundation Plan		7 JAN 05
34	S1.2	Roof Framing Plan		7 JAN 05
35	S2.1	Schedules		7 JAN 05
36	S2.2	Foundation Details		7 JAN 05
37	S2.3	Roof Details		7 JAN 05
38	S3.1	Braced Frames		7 JAN 05
39	S4.1	Truss Profiles		7 JAN 05
40	S4.2	Truss Details		7 JAN 05
41	FP1.1	Fire Sprinkler Legend, Notes, & Details		7 JAN 05
42	FP1.2	Fire Sprinkler Floor Plan		7 JAN 05
43	P1.1	Plumbing Legend & Schedules		7 JAN 05
44	P1.2	D-W-V Plan		7 JAN 05
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66	E4.0	Special Systems Plan		7 JAN 05
67	E5.0	Fire Alarm Plan		7 JAN 05

STANDARD DETAILS BOUND IN THE SPECIFICATIONS

DRAWING NUMBER	SHEET NUMBER	TITLE	DATE
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SECTION 01501 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

1 & 2	U.S. Air Force Project Construction Sign	84JUN20
1	Hard Hat Sign	10SEP90

END OF SECTION

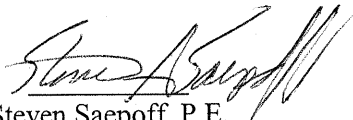
DESIGN AUTHENTICATION

Corrosion Control/AGE Facility, Malmstrom AFB, MT

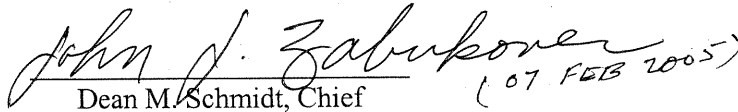
Signatures affixed below indicate the drawings and specifications included in this solicitation were prepared, reviewed and certified in accordance with Department of Army Engineer Regulation ER 1110-345-100, DESIGN POLICY FOR MILITARY CONSTRUCTION.

(Signed Drawings on File)

CTA Architects Engineers



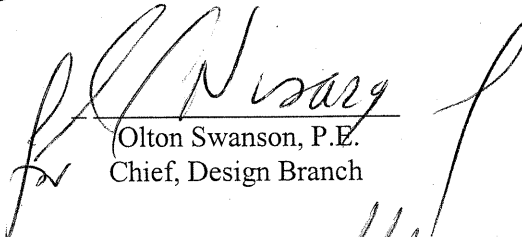
Steven Saepoff, P.E.
USACE Project Manager



(07 FEB 2005)

Dean M. Schmidt, Chief
Tech. Eng. & Review Section,
Construction Branch

For



Olton Swanson, P.E.
Chief, Design Branch



Mark A. Ohlstrom, P.E.
Chief, Engineering & Construction Division

This project was designed for the U.S. Army Corps of Engineers, Seattle District. The initials and/or signatures and registration designations of individuals appearing on these project documents are as required by ER 1110-1-8152, ENGINEERING AND DESIGN PROFESSIONAL REGISTRATION.

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WAIS Document Retrieval
GENERAL DECISION: MT20030005 11/26/2004 MT5

Date: November 26, 2004
General Decision Number: MT20030005 11/26/2004

Superseded General Decision Number: MT020005

State: Montana

Construction Type: Building

County: Cascade County in Montana.

BUILDING CONSTRUCTION PROJECTS (does not include residential construction consisting of single family homes and apartments up to and including 4 stories)

Modification Number	Publication Date
0	06/13/2003
1	11/07/2003
2	01/16/2004
3	01/23/2004
4	05/07/2004
5	11/26/2004

* BRMT0003-001 06/01/2004

	Rates	Fringes
Bricklayer.....	\$ 21.50	7.35

CARP0028-006 05/01/2003		

	Rates	Fringes
Carpenters: (Including Acoustical Ceiling Installation, Drywall Hanging, Non-Mechanical Batt Insulation, Installation of Gutters, Downspouts, Facia on Metal Buildings, Metal Roofs, and Siding)		
Zone 1.....	\$ 16.29	5.83
Millwright		
Zone 1.....	\$ 18.29	5.83

ZONE DEFINITIONS

The hourly rate applicable shall be determined by measuring the road miles over the shortest practical maintained route

from the county courthouse in Great Falls to the center of the job (employees living within a 15 mile radius of said project shall be considered Zone 1)

ZONE PAY (Add to Zone 1 basic hourly rate)

ZONE 1: 0 to 15 miles; Base Rate
ZONE 2: 15 to 30 miles, add \$0.75 to Zone 1 rate
ZONE 3: 30 to 50 miles, add \$1.00 to Zone 1 rate
ZONE 4: Over 50 miles, add \$1.50 to Zone 1 rate

ELEC0233-003 12/01/2003

	Rates	Fringes
Electrician.....	\$ 22.76	4.25%+7.70

IRON0841-003 07/01/2003

	Rates	Fringes
Ironworkers: (Structural & Reinforcing; Excluding installation of Gutters, Downspouts, Facia, Metal Roofs, and Siding on metal Buildings).....	\$ 19.20	12.51

* LAB01334-001 05/01/2004

	Rates	Fringes
Laborers: (Zone 1)		
Cement Mason Tender.....	\$ 15.94	5.40
Concrete Saw, Hod Carrier...	\$ 16.80	5.40
Power Tool.....	\$ 16.08	5.40

ZONE DEFINITIONS FOR LABORERS

The hourly wage rates applicable to each project shall be determined by measuring the road miles over the shortest practical maintained route from the County Courthouse in Great Falls to the center of the job.

ZONE 1: 0 to 15 miles
ZONE 2: 15 to 30 miles, add \$0.65 to Zone 1 rate.
ZONE 3: 30 to 50 miles, add \$0.85 to Zone 1 rate.
ZONE 4: Over 50 miles, add \$1.25 to Zone 1 rate.

* PLUM0030-004 09/01/2004

	Rates	Fringes
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Pipefitter (Including HVAC work).....	\$ 24.50	10.65

SFMT0669-001 04/01/2004		
	Rates	Fringes
Sprinkler Fitter.....	\$ 27.05	7.15

SHEE0103-001 07/01/2002		
	Rates	Fringes
Sheet Metal Worker (Including HVAC Duct Work).....	\$ 22.24	9.33

SUMT1992-001 08/01/1992		
	Rates	Fringes
Cement Mason.....	\$ 10.71	2.70
Drywall Finisher		
Hand.....	\$ 13.16	1.98
Machine.....	\$ 14.12	1.68
Glazier.....	\$ 13.68	
Insulator (Mechanical).....	\$ 18.84	2.27
Laborers:		
Asphalt Raker.....	\$ 11.32	2.88
Fence Erector.....	\$ 10.60	2.70
General.....	\$ 10.76	2.70
Landscape.....	\$ 10.60	2.70
Painters: (Excluding Drywall Finishing)		
Brush.....	\$ 12.52	1.48
Painters:		
Roller.....	\$ 13.10	1.48
Sandblaster.....	\$ 14.72	1.69
Spray.....	\$ 15.30	2.97
Plasterer.....	\$ 13.75	1.50
Plumber.....	\$ 18.55	2.77
Power Equipment Operator		
Asphalt Paver.....	\$ 14.35	2.89
Backhoe.....	\$ 14.57	2.92
Bulldozer.....	\$ 14.37	2.99
Crane, all sizes.....	\$ 15.85	3.01
Forklift.....	\$ 14.69	3.28
Front End Loader.....	\$ 14.31	3.39
Motor Patrol.....	\$ 14.43	3.23
Roller, Compaction.....	\$ 14.03	3.39
Roller, Hot Mix.....	\$ 14.57	2.89
Scraper.....	\$ 13.04	3.44

Roofer.....	\$ 13.15	
Soft Floor Layer.....	\$ 17.53	
Tile Setter.....	\$ 16.00	2.05
Truck drivers:		
Dump.....	\$ 14.58	3.02
Water/Fuel/Oil.....	\$ 14.19	2.65

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

=====

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

In the listing above, the "SU" designation means that rates listed under the identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division

U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

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SECTION 01001

SUPPLEMENTARY REQUIREMENTS

PART 1 GENERAL

1.1 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures:"

SD-01 Preconstruction Submittals

Safety Plan; G

Mechanical Electrical Layout Drawings

SD-10 Operations and Maintenance Data

Audio-Video Recordings; G

1.2 CONSTRUCTION SCHEDULING

The instructions for preparation and submittal of the Contractor-prepared Network Analysis System are found in SECTION 01320, PROJECT SCHEDULE.

1.3 CORRESPONDENCE

1.3.1 All correspondence shall be addressed to the Contracting Officer, shall be serially numbered commencing with Number 1, with no numbers missing or duplicated and shall be forwarded in quintuplicate, as directed by the authorized representative of the Contracting Officer, and shall include an additional copy forwarded to a separate designated location. All copies provided shall be legible. Enclosures attached or transmitted with the correspondence shall also be furnished with the original and each copy. Each serial letter shall make reference to the contract name, contract number and shall have only one subject.

1.3.2 For submission of Contractor payment requests, See Section 01025, PAYMENT.

1.4 ADVANCED NOTICE OF CONTRACTOR PERFORMED ACCEPTANCE TESTING

The Contractor shall notify the Contracting Officer a minimum of 20 days prior to performing any acceptance or "buy off" testing of the following systems, (1) EMCS, (2) Fire Detection/Protection, (3) Intrusion Detection System, (4) Uninterruptible Power Supply, (5) HVAC, (6) AFFF, and (7) Hydrant Refuel. Advance notification is not required for testing performed as part of fabrication or installation.

1.5 CONTRACTOR'S FILES

Contractor shall maintain "Approved (Action Code "A") and "Approved Except as Noted (Action Code "B") shop drawing files in fabrication shops and at project sites for government use.

1.6 AUDIO-VIDEO RECORDINGS

1.6.1 General

The Contractor shall provide all equipment, materials, and trained personnel to visually and audibly record (video tape) all on site operations and maintenance (O&M) training sessions for this contract. The video technician shall be employed by a video production company that has been in business for a minimum of 2 years. The Contractor shall submit the resume of the technician and video production company. Also the Contractor shall submit for approval an agenda or an outline breakdown of the proposed presentation. Video tapes shall be produced in the VHS format. Audio shall be adjusted, filtered or otherwise controlled to ensure that the trainer can be understood at all times. Each system or piece of equipment shall be covered in a single tape or set of tapes which shall be correlated with the O&M manuals provided. Video tapes and their individual storage cases shall be identified with a typewritten label showing the project, equipment or system, and contract number; this same information shall be provided as an introduction on each video tape. When two or more tapes are provided, they shall be submitted as a set in an appropriate storage container.

1.6.2 Submittals

Prior to conducting the training sessions the following shall be submitted for approval:

- 1) A training plan consisting of the agenda or an outline breakdown of the proposed presentation and
- 2) The qualifications of the trainer and the video recording technician

Two copies of the video taped material shall be submitted to the Contracting Officer within 10 days after completion of video taping the training sessions.

1.7 MECHANICAL AND ELECTRICAL LAYOUT DRAWINGS

The Contractor shall submit, for Contracting Officer's approval, scaled layout drawings, including appropriate elevations and sections, as required, showing the room arrangement the Contractor proposes for all pieces of mechanical and electrical equipment and appurtenances thereto, such as but not limited to: air conditioning equipment, boilers, compressors, hot water tanks, pumps, electrical control panels, ducts and piping that are to be located in the room. Mechanical and electrical layouts shall be coordinated to eliminate any conflicts of installed equipment. No payments will be made to the Contractor for furnishing or installing equipment until the layout drawings have been approved by the Contracting Officer. Mechanical and electrical equipment layout drawings shall be identified and submitted as specified herein. Equipment rooms

shown on the drawings are of adequate size to accommodate equipment of required capacities as available from several manufacturers with sufficient space left for access, servicing, and removal. The use of equipment items with dimensions such as "to crowd the space" will not be permitted.

1.8 PROJECT PHOTOGRAPHS

1.8.1 General

The Contractor shall furnish digital photographs depicting construction as specified herein. The photographs shall be in digital JPEG format, with a resolution of 1024 x 768 pixels or better, size limited to less than 300KB.

Photos shall be submitted in a Word document, with a caption under each photo showing date taken, project location, contract title and number, and a brief description of what the photo depicts. The photos shall be submitted on a 133 mm ISO-9660 CD-ROM.

1.8.2 Progress Photographs

Construction progress photographs shall be taken between the 1st and 15th of each month and delivered to the Contracting Officer with the payment request for the month taken. Photos shall be taken from 10 positions. Location of positions shall be coordinated with or may be selected by the Contracting Officer. They shall show, inasmuch as practicable, work accomplished during the previous month. Photographic quality and composition of photos shall be such that they can be used for briefings and/or to illustrate articles on the construction progress of the project.

1.9 COLOR BOARDS

Two sets of color boards shall be submitted within 60 calendar days after receipt of Notice to Proceed. The board shall include samples of colors and finishes of every finish such as on walls, floors, and ceilings. This would include, but not be limited to, paint, floor and wall tile, acoustical panels, carpet, wall base, plastic laminate, etc. Where special finishes such as architectural concrete or prefinished metal panels are required, samples of not less than 305 mm (12 inches) square shall be submitted with the board. Boards shall include, where applicable, color samples of integrally colored block, brick, and prefinished metal roofing and siding. The board shall be 610 mm by 610 mm (24 inches by 24 inches). If more space is needed, more than one board per set may be submitted. This is not meant to replace the samples called for in other portions of the specifications. The Contractor shall certify that he has reviewed the color boards in detail and that they are in strict accordance with the contract drawings and specifications, except as may be otherwise explicitly stated.

1.10 SAMPLE ROOM

After all finish materials have been submitted and approved, but prior to the installation of any of them, the Contractor shall construct and completely finish one sample room that is/will be representative of all other rooms. Finishes shall include, but not necessarily be limited to, paint, wall covering of any type, floor finish of any type including base,

ceiling finish of any type, and all electrical and mechanical finish trim. No payment will be made for any installation of finish materials until this room has been constructed and approved by a representative of the Contracting Officer. Once approved, this room shall serve as the "model" for finish and workmanship of all other rooms in the facility.

1.11 IDENTIFICATION OF EMPLOYEES AND MILITARY REGULATIONS:

The Contractor shall furnish a list of employees needing access on base to the Base Contracting Officer. Employees without a badge and identification in their possession will be denied access to the base and work areas. An AF Form 75 will be issued to contractors working for thirty days or less. Contractors working for thirty days to one year will be issued an Identocard 2000 Contractor ID Card upon presentation of a properly completed AF Form 355 from the contracting officer or designated representative. Contractors working for more than one year will be issued a base decal upon presentation of a properly completed AF Form 355 from the contracting officer or designated representative.

1.12 PERMITS OBTAINED BY GOVERNMENT AND CONTRACTOR RESPONSIBILITIES

The Government has obtained the following permits/licenses related to the construction of this project:

It will be the responsibility of the Contractor to obtain all other permits/licenses required for this project. See the Contract Clause paragraph entitled PERMITS AND RESPONSIBILITIES.

1.13 SPECIAL SAFETY REQUIREMENTS:

All construction activities shall be conducted in strict compliance with the Corps of Engineers Safety and Health Requirements Manual EM 385-1-1, and Occupational Safety and Health Administration regulations, as applicable. The manual is available on <http://www.hq.usace.army.mil/soh/em385/current/current38511.htm>

1.14.1 In addition to Safety and Health Requirements Manual EM 385 1 1, and all applicable OSHA standards, the Contractor shall comply with the requirements listed below. Paragraph numbers refer to EM 385 1 1 or are added thereto.

(a) Paragraph 01.D.02, revise as follows:

(1) Replace paragraph 01.D.02e with the following:
"e. Property damage in excess of \$2,000.00

(2) Add new paragraph f as follows:
"An injury resulting in a lost workday, not including the day of injury."

1.14 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER (ER 415-1-15 31 OCT 89)

This Paragraph specifies the procedure for the determination of time extensions for unusually severe weather in accordance with the CONTRACT CLAUSE entitled "Default (Fixed Price Construction)". In order for the

Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

1.15.1 The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

1.15.2 The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

1.15.3 The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The Contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY
WORK DAYS BASED ON (5) DAY WORK WEEK

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
19	15	16	10	4	4	2	2	3	6	13	17

1.15.4 Upon acknowledgment of the notice to proceed (NTP) and continuing throughout the contract, the Contractor shall record on the daily QCQ report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delays must prevent work on critical activities for 50 percent or more of the Contractor's scheduled work day.

1.15.5 The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph 1.15.3, above, the Contracting Officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the contract clause entitled " Default (Fixed Price Construction)".

1.15 SALVAGE MATERIALS AND EQUIPMENT FOR THE GOVERNMENT

The Contractor shall maintain adequate property control records for all materials or equipment specified to be salvaged. These records may be in accordance with the Contractor's system of property control, if approved by the property administrator. The Contractor shall be responsible for the adequate storage and protection of all salvaged materials and equipment, and shall replace, at no cost to the Government, all salvage materials and equipment which are broken or damaged during salvage operations as the result of his negligence, or while in his care.

1.16 COMPLIANCE WITH DAVIS-BACON ACT

1.16.1 Contractor POC

Within 14 days after award of the contract, the Contractor shall designate a point of contact (POC) within their organization who will be responsible for the Davis-Bacon Act Labor Program for the Contractor and all subcontractors under this contract as required by the Contract Clauses and FAR 52.222.

1.16.2 Responsibilities

The designated Contractor POC shall be responsible for Davis-Bacon Act Labor Program activities including, but not limited to:

- Documentation and record keeping
- Submittal and accuracy of certified payrolls
- Submittal of required labor forms including requests for additional classifications and rates, Statements and Acknowledgement, etc.
- Posting of the wage determination, approved additional classifications and rates, labor and EEO posters
- Coordination with the Contracting Officer's Labor Program POC

Prior to submittal to the Government, payrolls shall be reviewed for compliance to all applicable labor standards, to include, but not be limited to the following items: correct wage rates, correct overtime classification and pay, misclassification of workers for work actually performed, apprentice to journeyman ratios, and registration of apprentice.

Corrective actions shall be taken as necessary to ensure Contractor compliance with applicable contract and FAR clauses.

1.16.3 Certification

The Contractor POC shall provide a signed certification stating the following: "I certify that the submitted items being forwarded have been reviewed in detail and are correct and in strict conformance with the Labor Standards of the contract except as otherwise stated."

PART 2 NOT USED

PART 3 NOT USED

-- End of Section --

SECTION 01005

SITE SPECIFIC SUPPLEMENTARY REQUIREMENTS

PART 1 CONDUCT OF WORK

1.1 COORDINATION AND ACCESS TO SITE

Coordination with using agencies shall be made through the Contracting Officer to assist the Contractor in completing the work with a minimum of interference and inconvenience.

Work hours in the construction area will be restricted to 7:00 a.m. to 4:45 p.m. daily, Monday through Friday, excluding holidays. Work hours other than as specified above shall be coordinated with and approved by the Contracting Officer.

1.2 FIRE REGULATIONS

Contractor shall comply with base fire regulations and NFPA 241 Building Construction and Demolition requirements. Contractor shall provide adequate fire extinguishers for the construction site and remove them upon acceptance of the facility.

1.3 GENERAL AREA REQUIREMENTS

Security requirements and procedures shall be coordinated with the 341 Security Forces Squadron, Resource Protection (telephone 406-731-4344), Malmstrom AFB. Activities of the Contractor and Contractor's employees and subcontractors and their employees while on the base, will be conducted in accordance with base regulations, including those of the fire marshal, as well as security directives. This includes, but is not limited to, obtaining a Work Clearance Request (AF Form 103) before any digging and giving way to alert vehicles during alerts if located on a marked alert route. Security directives include Antiterrorism Force Protection (paragraph 1.3.4 below) and the HLS>GENERAL CONTRACTING ENTRY AUTHORITY LIST attached the end of this Section. This list shall include all Contractor personnel working on the base.

1.3.1 BASE CIVIL ENGINEERING WORK CLEARANCE REQUEST

Prior to the start of field operations and prior to any excavation performed under the subject contract, a Base Civil Engineering Work Clearance Request (AF Form 103), commonly known as a "digging permit" must be in the possession of the contractor. The document must be fully executed and signed by an approving officer of the Air Force. This permit will be provided to the contractor through the Malmstrom Project Office. The permit will take a minimum of 14 calendar days to procure after a written request is received from the contractor. The contractor shall be solely responsible for all repairs and damages occurring as a result of construction operations performed without a properly execute AF 103 and proper locates.

It is the sole responsibility of the contractor to make all requests for locates and marking to Air Force shops, groups, contractors, or other

parties listed on the permit (AF Form 103). It is also the sole responsibility of the contractor to make all requests for locates and marking by the private sector. Note that private companies supply numerous utilities and services on Malmstrom Air Force Base. AF Form 103 does not address coordination with private companies. Requests for locates by private firms shall be performed by the contractor in accordance with State of Montana and Federal regulations.

1.3.2 Identification Credentials

All Contractor personnel, except those not under the Contractor's direct control such as concrete trucks and material deliveries, will be required to process in and obtain an Application for Civilian Identification Card (DD Form 1172) from the Corps of Engineers Malmstrom AFB Project Office in Building 770 (7218 Goddard Dr., Suite 19). The Contractor shall provide the employee with a letter or form, identifying the employee and company name. After completion of the DD Form 1172, proceed to the Pass and ID Section at the Visitor Control Center in Building 192 (working hours - Monday through Friday - 7:30 a.m. to 4:30 p.m.) to obtain a base personnel access pass and vehicle pass. Current vehicle registration and proof of insurance are required for vehicle passes. The Contractor shall notify the Pass and ID Section of all losses of passes, within 48 hours after the loss, by name and address. Employees who have terminated employment or who have been dismissed must surrender their personnel and vehicle passes to the Visitors Control Center through the Contracting Officer. Employees without a personnel or vehicle pass in their possession will be denied access to the base and work areas and may be subject to detainment until proper identification is made. The passes shall not be worn or displayed off the military base.

1.3.3 Identification of Commercial or Company Vehicles

Commercial or company vehicles will be allowed access to the base provided company emblems are attached to the sides of the vehicles.

1.3.4 Equipment and storage areas:

See specification Section 01501 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS.

1.3.5 Antiterrorism Force Protection

During the course of this contract, the Base may be under Force Protection Conditions (FPCONS). FPCONS are as follows:

FPCON NORMAL: This condition applies when there is a general threat of possible terrorist activity exists warrants only a routine security posture.

FPCON ALPHA: This condition applies when there is a general threat of possible terrorist activity against personnel and facilities, the nature and extent of which are unpredictable, and circumstances do not justify full implementation of FPCON BRAVO measures. However, it may be necessary to

implement certain measures from higher FPCONS resulting from intelligence received or as a deterrent. The measures in this FPCON must be capable of being maintained indefinitely.

FPCON BRAVO: This condition applies when an increased and more predictable threat of terrorist activity exists. The measures in this FPCON must be capable of being maintained for weeks without causing undue hardship, affecting operational capability, and aggravating relations with local authorities.

FPCON CHARLIE: This condition applies when an incident occurs or intelligence is received indicating some form of terrorist action against personnel and facilities is imminent. Implementation of measures in this FPCON for more than a short period probably create hardship and affect the peacetime activities of the unit and its personnel.

FPCON DELTA: This condition applies in the immediate area where a terrorist attack has occurred or when intelligence has been received that terrorist action against a specific location or person is likely. Normally, this FPCON is declared as a localized condition.

If the Contractor should notice anything suspicious during the course of his work, the Contractor should contact the 911 Dispatch Center at 731-3895 as soon as possible. Point of Contact for FPCON conditions/actions is 341st Space Wing AT/FP Section, phone 406-731-4105.

1.4 CONSTRUCTION AND STAGING AREA FENCE

The Contractor shall provide fence around all construction areas, staging areas and storage areas. The fence shall be chain link, 6 ft. high, with construction area signage at each corner and at 100 ft. intervals.

1.5 MOTORIZED EQUIPMENT

1.5.1 Truck Load Limits

Truck load limits on base are restricted to:

1 April - 1 June: -- 350 pounds per inch width of tire.
All other times: -- 400 pounds per inch width of tire.

Trucks shall periodically be required to pass over the base truck scale to verify compliance with the above vehicle load limits.

1.5.2 Fire Extinguishers

Motorized equipment shall be equipped with fire extinguishers as follows:

a. Pickup truck or other light passenger vehicles, one extinguisher per vehicle, rating 5 BC.

- b. All other trucks and heavy motorized equipment, two extinguishers per vehicle, rating 10 BC.

1.6 UTILITY OUTAGES

Contractor shall schedule and coordinate unavoidable utility outages with the Contracting Officer and Base Civil Engineer at least 10 days in advance. Unless indicated otherwise, the Contractor shall give 14 days preliminary notice of future outage. Final notice shall be given 10 calendar days before outage and shall specify date and time of the outage. The 'Utility Outage Notice' shall be completed by the Contractor and submitted to the Contracting Officer for approval. No interruptions shall be made until the approved Notice is returned to the Contractor. Outage durations shall be kept to a minimum. All outages longer than 2 hours shall be after normal duty hours or on a weekend at the Government option. Outages in dormitories or housing units shall be performed during business hours to minimize disruption to occupants. All outages that affect heating system motors or controls during heating season shall require the Contractor to connect backup power at the Contractor's expense during the outage, as may required by the Government.

1.7 UTILITY SERVICE AND COORDINATION

1.7.1 Natural Gas Service

Extension of and/or connection to the existing natural gas distribution system is the responsibility of the Contractor. All natural gas work shall be performed in accordance with the supplier's requirements. Additionally, all natural gas work must be performed as depicted on the drawings, and as required by the contract specifications.

1.7.2 Electrical Service

All electrical distribution work including the street light system and temporary and permanent electrical services shall be performed by Contractor. All electrical distribution work shall be performed in accordance with the supplier's requirements and the most current versions of the National Electric Safety Code and the National Electric Code (NFPA 70). Additionally, all permanent electrical distribution work must be performed as depicted on the drawings, and as required by the contract specifications. In any case of conflict between the applicable codes or references listed above, the most restrictive shall apply.

1.7.3 Telephone Service

Telephone cable and pedestal installation will be by Qwest. Network interface devices (NID) and installation will be by Qwest. Site trenching, backfill and the installation of conduit shall be performed by Contractor. Point(s) of Contact for Qwest is shown in Section 16710 COMMUNICATIONS CIRCUITS, paragraph 1.3 System Description.

1.7.4 CATV Service

CATV cable and pedestal installation will be by AT&T Broadband. Network

interface devices (NID) and installation will be by AT&T Broadband. Site trenching, backfill and the installation of conduit shall be by Contractor.

Point(s) of Contact for AT&T Broadband is shown in Section 16710 COMMUNICATIONS CIRCUITS, paragraph 1.3 System Description

1.8 PROTECTION OF GOVERNMENT PROPERTY

In addition to requirements of the CONTRACT CLAUSES, Contractor shall protect all Government property within the buildings in which he is working, except for such property as is required to be demolished. Property that is to be demolished shall be protected until its scheduled demolition time. Protection shall include, but not be limited to, protection from construction generated dust, debris, water, and vibration.

1.9 COORDINATION OF WORK

The Contractor shall arrange his work schedule in such a way to maintain two-lane road passage at all times unless prior approval is granted by the Contracting Officer. The Contractor shall be responsible for coordinating lane closures with Malmstrom Air Force Base emergency response personnel (Base Fire Department, Law Enforcement and ambulance services), city and county emergency response personnel, trash collection contractor and school bus operators. A work schedule shall be prepared in writing and approved by the Contracting Officer's least 14 days prior to the start of work. A traffic control plan prepared in accordance with the most recent version of the Manual on Uniform Traffic Control Devices shall be submitted and approved by the government prior to any road demolition, construction, or lane closure.

PART 2 (NOT USED)

PART 3 (NOT USED)

-- End of Section --

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SECTION 01025

PAYMENT

PART 1 GENERAL

1.1 GENERAL

The contract price for each item shall constitute full compensation for furnishing all plant, labor, materials, appurtenances, and incidentals and performing all operations necessary to construct and complete the items in accordance with these specifications and the applicable drawings, including surveying performed by the Contractor. Payment for each item shall be considered as full compensation, notwithstanding that minor features may not be mentioned herein. Work paid for under one item will not be paid for under any other item. No separate payment will be made for the work, services, or operations required by the Contractor, as specified in DIVISION 1, GENERAL REQUIREMENTS, to complete the project in accordance with these specifications; all costs thereof shall be considered as incidental to the work.

1.2 PAYMENT

1.2.1 ITEM 0001 (BASE ITEM)

Payment will be made at the contract lump sum price for Item No. 0001, All Work for Corrosion Control / AGE Facility, Except for Items 0002, 0003, 0004 and 0005, payment of which shall constitute full compensation for Item No. 0001, complete.

1.2.2 ITEM 0002 (BASE ITEM)

Payment will be made at the contract lump sum price for Item No. 0002, All Work for HAZMAT Contractor Authorization Procedures, as Specified in Section 01355, payment of which shall constitute full compensation for Item No. 0002, complete.

1.2.3 ITEM 0003 (BASE ITEM)

Payment will be made at the contract lump sum price for Item No. 0003, All Work for As-Built Drawings as specified in Section 01702 from preparation to final approval, payment of which shall constitute full compensation for Item No. 0003, complete. No partial or total payment will be made for this item until the as-built drawings, both marked up blue prints and electronic files are fully approved by the Government (A or B action) and all copies of approved drawings and electronic media received by the Government.

1.2.4 ITEM 0004 (BASE ITEM)

Payment will be made at the contract lump sum price for Item No. 0004, All Work for O&M Manuals as as specified in Section 01701 from preparation to

final approval, payment of which shall constitute full compensation for Item No. 0004, complete. No partial or total payment will be made for this item until all O&M manuals are fully approved by the Government (A or B action) and all copies of final manuals are received by the Government in their final binders.

1.2.5 ITEM 0005 (BASE ITEM)

Payment will be made that the contract lump sum price for Item No. 0005, All Work for Form 1354 Checklist and Equipment in Place List as specified in Sections 01704 and 01705 from preparation to final approval, payment of which shall constitute full compensation for Item No. 0005, complete. No partial or total payment will be made for this item until both the 1354 Checklist and Equipment in Place List are fully approved by the Government (A or B action) and all copies of approved lists received by the Government.

1.3 PROGRESS PAYMENT INVOICE

Requests for payment shall be submitted in accordance with Federal Acquisition Regulations (FAR) Subpart 32.9, entitled "PROMPT PAYMENT", and Paragraphs 52.232-5 and 52.232-27, entitled "Payments Under Fixed-Price Construction Contracts", and "Prompt Payment for Construction Contracts", respectively. In addition each request shall be submitted in the number of copies and to the designated billing office as shown in the Contract.

1.3.1 When submitting payment requests, the Contractor shall complete Blocks 1 through 12 of the "PROGRESS PAYMENT INVOICE" Form as directed by the Contracting Officer. (A sample form is attached at the end of this Technical Specification Section.) The completed form shall then become the cover document to which all other support data shall be attached.

1.3.2 One additional copy of the entire request for payment, to include the "PROGRESS PAYMENT INVOICE" cover document, shall be forwarded to a separate address as designated by the Contracting Officer.

1.3.3 The Contractor shall submit with each pay request, a list of subcontractors that have worked during that pay period. The listing shall be broken down into weeks, identifying each subcontractor that has worked during a particular week, and indicate the total number of employees that have worked on site for each subcontractor for each week. The prime Contractor shall also indicate the total number of employees for its on site staff for each week.

PART 2 NOT USED

PART 3 NOT USED

-- End of Section --

See Federal Acquisition Regulations (FAR) 32.900, 52.232-5, & 52.232-27

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SECTION 01035

MODIFICATION PROCEDURES

PART 1 GENERAL

1.1 PROPOSED PROJECT MODIFICATIONS:

Price proposals for proposed modifications shall be submitted in accordance with the requirements of the Contract Clause MODIFICATION PROPOSALS - PRICE BREAKDOWNS. If change order work impacts or delays other unchanged contract work, the costs of such impacts or delays shall be included in the proposals and separately identified. Additional instructions for submitting price proposals can be found in NPSP-415-1-1, INSTRUCTION AND INFORMATION FOR CONTRACTORS, a copy of which will be furnished to the Contractor at the Preconstruction Conference. For information applicable to equipment rates used in contract modifications, refer to 00800 - SPECIAL CLAUSES, clause "EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE".

PART 2 NOT USED

PART 3 NOT USED

-- End of Section --

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SECTION 01312

QUALITY CONTROL SYSTEM (QCS)

PART 1 GENERAL

1.1 GENERAL

The Government will use the Resident Management System for Windows (RMS) to assist in its monitoring and administration of this contract. The Contractor shall use the Government-furnished Construction Contractor Module of RMS, referred to as QCS, to record, maintain, and submit various information throughout the contract period. This joint Government-Contractor use of RMS and QCS will facilitate electronic exchange of information and overall management of the contract. QCS provides the means for the Contractor to input, track, and electronically share information with the Government in the following areas:

- Administration
- Finances
- Quality Control
- Submittal Monitoring
- Scheduling
- Import/Export of Data

1.1.1 Correspondence and Electronic Communications

For ease and speed of communications, both Government and Contractor will, to the maximum extent feasible, exchange correspondence and other documents in electronic format. Correspondence, pay requests and other documents comprising the official contract record shall also be provided in paper format, with signatures and dates where necessary. Paper documents will govern, in the event of discrepancy with the electronic version.

1.1.2 Other Factors

Particular attention is directed to Contract Clause, "Schedules for Construction Contracts", Contract Clause, "Payments", Section 01320A, PROJECT SCHEDULE, Section 01330, SUBMITTAL PROCEDURES, and Section 01451A, CONTRACTOR QUALITY CONTROL, which have a direct relationship to the reporting to be accomplished through QCS. Also, there is no separate payment for establishing and maintaining the QCS database; all costs associated therewith shall be included in the contract pricing for the work.

1.2 QCS SOFTWARE

QCS is a Windows-based program that can be run on a stand-alone personal computer or on a network. The Government will make available the QCS software to the Contractor after award of the construction contract. Prior to the Pre-Construction Conference, the Contractor shall be responsible to download, install and use the latest version of the QCS software from the

Government's RMS Internet Website. Upon specific justification and request by the Contractor, the Government can provide QCS on 3-1/2 inch high-density diskettes or CD-ROM. Any program updates of QCS will be made available to the Contractor via the Government RMS Website as they become available.

1.3 SYSTEM REQUIREMENTS

The following listed hardware and software is the minimum system configuration that the Contractor shall have to run QCS:

Hardware

IBM-compatible PC with 200 MHz Pentium or higher processor

32+ MB RAM

4 GB hard drive disk space for sole use by the QCS system

3 1/2 inch high-density floppy drive

Compact disk (CD) Reader

Color monitor

Laser printer compatible with HP LaserJet III or better, with minimum 4 MB installed memory.

Connection to the Internet, minimum 28 BPS

Software

MS Windows 95 or newer version operating system (MS Windows NT 4.0 or newer is recommended)

Word Processing software compatible with MS Word 97 or newer

Internet browser

The Contractor's computer system shall be protected by virus protection software that is regularly upgraded with all issued manufacturer's updates throughout the life of the contract.

Electronic mail (E-mail) compatible with MS Outlook

1.4 RELATED INFORMATION

1.4.1 QCS User Guide

After contract award, the Contractor shall download instructions for the installation and use of QCS from the Government RMS Internet Website; the Contractor can obtain the current address from the Government. In case of justifiable difficulties, the Government will provide the Contractor with a

CD-ROM containing these instructions.

1.4.2 Contractor Quality Control(CQC) Training

The use of QCS will be discussed with the Contractor's QC System Manager during the mandatory CQC Training class.

1.5 CONTRACT DATABASE

Prior to the pre-construction conference, the Government shall provide the Contractor with basic contract award data to use for QCS. The Government will provide data updates to the Contractor as needed, generally by files attached to E-mail. These updates will generally consist of submittal reviews, correspondence status, QA comments, and other administrative and QA data.

1.6 DATABASE MAINTENANCE

The Contractor shall establish, maintain, and update data for the contract in the QCS database throughout the duration of the contract. The Contractor shall establish and maintain the QCS database at the Contractor's site office. Data updates to the Government shall be submitted by E-mail with file attachments, e.g., daily reports, schedule updates, payment requests. If permitted by the Contracting Officer, a data diskette or CD-ROM may be used instead of E-mail (see Paragraph DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM). The QCS database typically shall include current data on the following items:

1.6.1 Administration

1.6.1.1 Contractor Information

The database shall contain the Contractor's name, address, telephone numbers, management staff, and other required items. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver Contractor administrative data in electronic format via E-mail.

1.6.1.2 Subcontractor Information

The database shall contain the name, trade, address, phone numbers, and other required information for all subcontractors. A subcontractor must be listed separately for each trade to be performed. Each subcontractor/trade shall be assigned a unique Responsibility Code, provided in QCS. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver subcontractor administrative data in electronic format via E-mail.

1.6.1.3 Correspondence

All Contractor correspondence to the Government shall be identified with a serial number. Correspondence initiated by the Contractor's site office shall be prefixed with "S". Letters initiated by the Contractor's home (main) office shall be prefixed with "H". Letters shall be numbered starting from 0001. (e.g., H-0001 or S-0001). The Government's letters to

the Contractor will be prefixed with "C".

1.6.1.4 Equipment

The Contractor's QCS database shall contain a current list of equipment planned for use or being used on the jobsite, including the most recent and planned equipment inspection dates.

1.6.1.5 Management Reporting

QCS includes a number of reports that Contractor management can use to track the status of the project. The value of these reports is reflective of the quality of the data input, and is maintained in the various sections of QCS. Among these reports are: Progress Payment Request worksheet, QA/QC comments, Submittal Register Status, Three-Phase Inspection checklists.

1.6.2 Finances

1.6.2.1 Pay Activity Data

The QCS database shall include a list of pay activities that the Contractor shall develop in conjunction with the construction schedule. The sum of all pay activities shall be equal to the total contract amount, including modifications. Pay activities shall be grouped by Contract Line Item Number (CLIN), and the sum of the activities shall equal the amount of each CLIN. The total of all CLINs equals the Contract Amount.

1.6.2.2 Payment Requests

All progress payment requests shall be prepared using QCS. The Contractor shall complete the payment request worksheet and include it with the payment request. The work completed under the contract, measured as percent or as specific quantities, shall be updated at least monthly. After the update, the Contractor shall generate a payment request report using QCS. The Contractor shall submit the payment requests with supporting data by E-mail with file attachment(s). If permitted by the Contracting Officer, a data diskette may be used instead of E-mail. A signed paper copy of the approved payment request is also required, which shall govern in the event of discrepancy with the electronic version.

1.6.3 Quality Control (QC)

QCS provides a means to track implementation of the 3-phase QC Control System, prepare daily reports, identify and track deficiencies, document progress of work, and support other contractor QC requirements. The Contractor shall maintain this data on a daily basis. Entered data will automatically output to the QCS generated daily report. The Contractor shall provide the Government a Contractor Quality Control (CQC) Plan within the time required in Section 01451A, CONTRACTOR QUALITY CONTROL. Within seven calendar days of Government acceptance, the Contractor shall submit a data diskette or CD-ROM reflecting the information contained in the accepted CQC Plan: schedule, pay activities, features of work, submittal register, QC requirements, and equipment list.

1.6.3.1 Daily Contractor Quality Control (CQC) Reports.

QCS includes the means to produce the Daily CQC Report. The Contractor may use other formats to record basic QC data. However, the Daily CQC Report generated by QCS shall be the Contractor's official report. Data from any supplemental reports by the Contractor shall be summarized and consolidated onto the QCS-generated Daily CQC Report. Daily CQC Reports shall be submitted as required by Section 01451A, CONTRACTOR QUALITY CONTROL. Reports shall be submitted electronically to the Government using E-mail or diskette within 24 hours after the date covered by the report. Use of either mode of submittal shall be coordinated with the Government representative. The Contractor shall also provide the Government a signed, printed copy of the daily CQC report.

1.6.3.2 Deficiency Tracking.

The Contractor shall use QCS to track deficiencies. Deficiencies identified by the Contractor will be numerically tracked using QC punch list items. The Contractor shall maintain a current log of its QC punch list items in the QCS database. The Government will log the deficiencies it has identified using its QA punch list items. The Government's QA punch list items will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of both QC and QA punch list items.

1.6.3.3 Three-Phase Control Meetings

The Contractor shall maintain scheduled and actual dates and times of preparatory and initial control meetings in QCS.

1.6.3.4 Accident/Safety Tracking.

The Government will issue safety comments, directions, or guidance whenever safety deficiencies are observed. The Government's safety comments will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of the safety comments. In addition, the Contractor shall utilize QCS to advise the Government of any accidents occurring on the jobsite. This brief supplemental entry is not to be considered as a substitute for completion of mandatory reports, e.g., ENG Form 3394 and OSHA Form 200.

1.6.3.5 Features of Work

The Contractor shall include a complete list of the features of work in the QCS database. A feature of work may be associated with multiple pay activities. However, each pay activity (see subparagraph "Pay Activity Data" of paragraph "Finances") will only be linked to a single feature of work.

1.6.3.6 QC Requirements

The Contractor shall develop and maintain a complete list of QC testing, transferred and installed property, and user training requirements in QCS. The Contractor shall update all data on these QC requirements as work

progresses, and shall promptly provide this information to the Government via QCS.

1.6.4 Submittal Management

The [Contractor shall][Government will] provide the initial submittal register, ENG Form 4288, SUBMITTAL REGISTER in electronic format. Thereafter, the Contractor shall maintain a complete list of all submittals, including completion of all data columns. Dates on which submittals are received and returned by the Government will be included in its export file to the Contractor. The Contractor shall use QCS to track and transmit all submittals. ENG Form 4025, submittal transmittal form, and the submittal register update, ENG Form 4288, shall be produced using QCS. RMS will be used to update, store and exchange submittal registers and transmittals, but will not be used for storage of actual submittals.

1.6.5 Schedule

The Contractor shall develop a construction schedule consisting of pay activities, in accordance with Contract Clause "Schedules for Construction Contracts", or Section 01320A, PROJECT SCHEDULE, as applicable. This schedule shall be input and maintained in the QCS database either manually or by using the Standard Data Exchange Format (SDEF) (see Section 01320A PROJECT SCHEDULE). The updated schedule data shall be included with each pay request submitted by the Contractor.

1.6.6 Import/Export of Data

QCS includes the ability to export Contractor data to the Government and to import submittal register and other Government-provided data, and schedule data using SDEF.

1.7 IMPLEMENTATION

Contractor use of QCS as described in the preceding paragraphs is mandatory. The Contractor shall ensure that sufficient resources are available to maintain its QCS database, and to provide the Government with regular database updates. QCS shall be an integral part of the Contractor's management of quality control.

1.8 DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM

The Government-preferred method for Contractor's submission of updates, payment requests, correspondence and other data is by E-mail with file attachment(s). For locations where this is not feasible, the Contracting Officer may permit use of computer diskettes or CD-ROM for data transfer. Data on the disks or CDs shall be exported using the QCS built-in export function. If used, diskettes and CD-ROMs will be submitted in accordance with the following:

1.8.1 File Medium

The Contractor shall submit required data on 3-1/2 inch double-sided high-density diskettes formatted to hold 1.44 MB of data, capable of

running under Microsoft Windows 95 or newer. Alternatively, CD-ROMs may be used. They shall conform to industry standards used in the United States. All data shall be provided in English.

1.8.2 Disk or CD-ROM Labels

The Contractor shall affix a permanent exterior label to each diskette and CD-ROM submitted. The label shall indicate in English, the QCS file name, full contract number, contract name, project location, data date, name and telephone number of person responsible for the data.

1.8.3 File Names

The Government will provide the file names to be used by the Contractor with the QCS software.

1.9 MONTHLY COORDINATION MEETING

The Contractor shall update the QCS database each workday. At least monthly, the Contractor shall generate and submit an export file to the Government with schedule update and progress payment request. As required in Contract Clause "Payments", at least one week prior to submittal, the Contractor shall meet with the Government representative to review the planned progress payment data submission for errors and omissions. The Contractor shall make all required corrections prior to Government acceptance of the export file and progress payment request. Payment requests accompanied by incomplete or incorrect data submittals will be returned. The Government will not process progress payments until an acceptable QCS export file is received.

1.10 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the requirements of this specification. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification.

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SECTION 01320

PROJECT SCHEDULE

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having this designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Schedules

Preliminary project schedule, two (2) copies; G

initial project schedule, two (2) copies; G

Activity No. Sort

Predecessor/successor listing

Cost Schedule

Floppy Disk with schedule data in Standard Data Exchange Format (SDEF).

Activity Code Dictionary.

Periodic schedules updates, monthly updates two (2) copies

Floppy Disks with schedule data in Standard Data Exchange Format (SDEF).

Narrative

Activity No. Sort

Cost Schedule

Cash Flow Report (S-Curve)

SD-08 Statements

Qualifications; G

Documentation showing qualifications of personnel preparing schedule reports.

1.2 QUALIFICATIONS

The Contractor shall designate an authorized representative who shall be responsible for the preparation of all required project schedule reports. This person shall have previously created and reviewed computerized schedules. Qualifications of this individual shall be submitted to the Contracting Officer for review with the Preliminary Project Schedule submission.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL

Pursuant to the Contract Clause, SCHEDULE FOR CONSTRUCTION CONTRACTS a Project Schedule as described below shall be prepared. The scheduling of [design and]construction shall be the responsibility of the Contractor. Contractor management personnel shall actively participate in its development. [Subcontractors][Designers, subcontractors] and suppliers working on the project should also contribute in developing and maintaining an accurate Project Schedule. The approved Project Schedule shall be used to measure the progress of the work, to aid in evaluating time extensions, and to provide the basis of all progress payments.

3.2 BASIS FOR PAYMENT

The schedule shall be the basis for measuring Contractor progress. Lack of an approved schedule or scheduling personnel will result in an inability of the Contracting Officer to evaluate Contractor progress for the purposes of payment. Failure of the Contractor to provide all information, as specified below, shall result in the disapproval of the entire Project Schedule submission and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. In the case where Project Schedule revisions have been directed by the Contracting Officer and those revisions have not been included in the Project Schedule, then the Contracting Officer may hold retainage up to the maximum allowed by contract, each payment period, until revisions to the Project Schedule have been made.

3.3 PROJECT SCHEDULE

The computer software system utilized by the Contractor to produce the Project Schedule shall be capable of providing all requirements of this specification including the SDEF (Standard Data Exchange Format). Failure of the Contractor to meet the requirements of this specification shall result in the disapproval of the schedule. Manual methods used to produce any required information shall require approval by the Contracting Officer.

3.3.1 Use of the Critical Path Method

The Critical Path Method (CPM) of network calculation shall be used to generate the Project Schedule. The Contractor shall provide the Project Schedule in Precedence Diagram Method (PDM).

3.3.2 Level of Detail Required

With the exception of the initial and preliminary schedule submission, the Project Schedule shall include an appropriate level of detail. Failure to develop or update the Project Schedule or provide data to the Contracting Officer at the appropriate level of detail, as specified by the Contracting Officer, shall result in the disapproval of the schedule. The Contracting Officer will use, but is not limited to, the following conditions to determine the appropriate level of detail to be used in the Project Schedule.

3.3.2.1 Activity Durations

Contractor submissions shall be required to follow the direction of the Contracting Officer regarding reasonable activity durations. Reasonable durations are those that allow the progress of activities to be accurately determined between payment periods. A rule of thumb, that the Contractor should use, is that less than 2 percent of all non-procurement activities' Original Durations shall be greater than 20 days.

[3.3.2.2 Design and Permit Activities

Design and permitting activities, including necessary conferences and follow-up actions and design package submission dates, shall be integrated into the schedule.

]3.3.2.3 Procurement Activities

Tasks related to the procurement of long lead materials or equipment shall be included as separate activities in the project schedule. Long lead materials and equipment are those materials that have a procurement cycle of over 90 days. Examples of procurement process activities include, but are not limited to: submittals, approvals, procurement, fabrication, delivery, installation, start-up, and testing.

3.3.2.4 Government Activities

Government and other agencies activities that could impact progress shall be shown. These activities include, but are not limited to: approvals, [design reviews, environmental permit approvals by State regulators,]inspections, utility tie-in, Government Furnished Equipment (GFE) and notice to proceed for phasing requirements.

3.3.2.5 Responsibility

All activities shall be identified in the project schedule by the party responsible to perform the work. Responsibility includes, but is not limited to, the subcontracting firm, (at the lowest tier), Contractor work force, or Government agency performing a given task. Activities shall not belong to more than one responsible party. The responsible party for each activity shall be identified by the Responsibility Code.

3.3.2.6 Work Areas

All activities shall be identified in the project schedule by the work area in which the activity occurs. Activities shall not be allowed to cover more than one work area. The work area of each activity shall be identified by the Work Area Code.

3.3.2.7 Modification or Claim Number

Any activity that is added or changed by contract modification or used to justify claimed time shall be identified by a mod or claim code that changed the activity. Activities shall not belong to more than one modification or claim item. The modification or claim number of each activity shall be identified by the Mod or Claim Number. Whenever possible,

changes shall be added to the schedule by adding new activities. Existing activities shall not normally be changed to reflect modifications.

3.3.2.8 Bid Item

All activities shall be identified in the project schedule by the Bid Item to which the activity belongs. An activity shall not contain work in more than one bid item. The bid item for each appropriate activity shall be identified by the Bid Item Code.

3.3.2.9 Phase of Work

All activities shall be identified in project schedule by phases of work in which the activity occurs. Activities shall not contain work in more than one phase of work. The project phase of each activity shall be by the unique Phase of Work Code.

3.3.2.10 Category of Work

All Activities shall be identified in the project schedule according to the category of work which best describes the activity. Category of work refers, but is not limited, to the procurement chain of activities including such items as [designs, design package submissions design reviews, review conferences, permits,]submittals, approvals, procurement, fabrication, delivery, installation, start-up, and testing. The category of work for each activity shall be identified by the Category of Work Code.

3.3.2.11 Feature of Work

All activities shall be identified in the project schedule according to the feature of work to which the activity belongs. Feature of work refers, but is not limited to a work breakdown structure for the project. The feature of work for each activity shall be identified by the Feature of Work Code.

3.3.2.12 Critical Activities

The following activities shall be listed as separate line activities on a Contractor's project schedule:

- Submission and approval of mechanical/electric layout drawings
- Submission and approval of O&M manuals
- Submission and approval of as-built drawings
- Submission and approval of 1354 data and installed equipment lists
- Submission and approval of testing and air balance (TAB) firm
- Submission of TAB specialist design review report
- Submission and approval of fire protection specialist
- Submission and approval of testing and balancing and HVAC commissioning plans and data
 - Air and water balance dates
 - HVAC commissioning dates
 - Controls testing plan
 - Controls testing
 - Performance Verification testing
 - Other systems testing, if required

Prefinal inspection
Correction of punchlist from prefinal inspection
Final inspection

The Contractor shall create a separate sub-network related to testing and commissioning mechanical systems. As a minimum, the sub-network shall contain the information and activities as shown on Figures 1 and 2 at the end of this Section. Failure to furnish this separate sub-network within the same time frame required for the Initial Project Schedule submission (see paragraph "Initial Project Schedule Submission") shall be cause for the Government to hold retainage up to the maximum allowed by contract, each payment period, until the sub-network is received, reviewed, and approved.

3.3.3 Scheduled Project Completion

The schedule interval shall extend from notice-to-proceed to the contract completion date.

3.3.3.1 Project Start Date

The schedule shall start no earlier than the date that the Notice to Proceed (NTP) was acknowledged. The Contractor shall include as the first activity in the project schedule an activity called "Start Project". The "Start Project" activity shall have: a "ES" constraint, a constraint date equal to the date that the NTP was acknowledged, and a zero day duration.

3.3.3.2 Constraint of Last Activity

Completion of the last activity in the schedule shall be constrained by the contract completion date. Calculation on project updates shall be such that if the early finish of the last activity falls after the contract completion date, then the float calculation shall reflect a negative float on the critical path. The Contractor shall include as the last activity in the project schedule an activity call "End Project". The "End Project" activity shall have: a "LF" constraint, a constraint date equal to the completion date for the project, and a zero day duration.

3.3.3.3 Early Project Completion

In the event the project schedule shows completion of the project prior to the contract completion date, the Contractor shall identify those activities that have been accelerated and/or those activities that are scheduled in parallel to support the Contractor's "early" completion. Contractor shall specifically address each of the activities noted at every project schedule update period to assist the Contracting Officer to evaluate the Contractor's ability to actually complete prior to the contract period.

3.3.4 Interim Completion Dates

Contractually specified interim completion dates shall also be constrained to show negative float if the early finish date of the last activity in that phase falls after the interim completion date.

3.3.4.1 Start Phase

The Contractor shall include as the first activity for a project phase an activity called "Start Phase X" where "X" refers to the phase of work. "Start Phase X" activity shall have an "ES" constraint date equal to the date on which the NTP was acknowledged, and a zero day duration.

3.3.4.2 End Phase

The Contractor shall include as the last activity in a project phase an activity called "End Phase X" where "X" refers to the phase of work. The "End Phase X" activity shall have an "LF" constraint date equal to the completion date for the project, and a zero day duration.

3.3.4.3 Phase X

The Contractor shall include a hammock type activity for each project phase called "Phase X" where "X" refers to the phase of work. The "Phase X" activity shall be logically tied to the earliest and latest activities in the phase.

3.3.5 Default Progress Data Disallowed

Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in CPM scheduling software systems. Actual Start and Finish dates on the CPM schedule shall match those dates provided from Contractor Quality Control Reports. Failure of the Contractor to document the Actual Start and Finish dates on the Daily Quality Control report for every in progress or completed activity and ensure that the data contained on the Daily Quality Control reports is the sole basis for schedule updating shall result in the disapproval of the Contractor's schedule and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes.

3.3.6 Out-of-Sequence Progress

Activities that have posted progress without predecessors being completed (Out-of-Sequence Progress) shall be allowed only by the case-by-case approval of the Contracting Officer. The Contracting Officer may direct that changes in schedule logic be made to correct any or all out-of-sequence work.

3.3.7 Negative Lags

Lag durations contained in the project schedule shall not have a negative value.

3.4 PROJECT SCHEDULE SUBMISSIONS

The Contractor shall provide the submissions as described below. The data disk, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS.

3.4.1 Preliminary Project Schedule Submission

The Preliminary Project Schedule, defining the Contractor's planned operations for the first 60 calendar days shall be submitted for approval within 10 calendar days after Notice to Proceed is acknowledged. The approved preliminary schedule shall be used for payment purposes not to exceed 60 calendar days after Notice to Proceed.

3.4.2 Initial Project Schedule Submission

The Initial Project Schedule shall be submitted for approval within 40 calendar days after Notice to Proceed. The schedule shall provide a reasonable sequence of activities which represent work through the entire project and shall be at a reasonable level of detail.

3.4.3 Periodic Schedule Updates

Based on the result of progress meetings, specified in "Periodic Progress Meetings," the Contractor shall submit periodic schedule updates. These submissions shall enable the Contracting Officer or to assess Contractor's progress. If the Contractor fails or refuses to furnish the information and project schedule data, which in the judgment of the Contracting Officer or authorized representative, is necessary for verifying the contractor's progress, the Contractor shall be deemed not to have provided an estimate upon which progress payment may be made.

3.4.4 Standard Activity Coding Dictionary

The Contractor shall submit, with the Initial Project Schedule, a coding scheme that shall be used throughout the project for all activity codes contained in the schedule. The coding scheme submitted shall list the values for each activity code category and translate those values into project specific designations. For example, a Responsibility Code Value, "ELE", may be identified as "Electrical Subcontractor." Activity code values shall represent the same information throughout the duration of the contract. Once approved with the Initial Project Schedule submission, changes to the activity coding scheme must be approved by the Contracting Officer.

3.5 SUBMISSION REQUIREMENTS

The as noted in paragraph 1.1 items shall be submitted by the Contractor for the preliminary submission, initial submission, and every periodic project schedule update throughout the life of the project:

3.5.1 Data Disks

Two data disks containing the project schedule shall be provided. Data on the disks adhere to the SDEF format specified in ER 1-1-11, Appendix A.

3.5.1.1 File Medium

Required data shall be submitted on CD-R disks, formatted to hold 650 MB of data.

3.5.1.2 Disk Label

A permanent exterior label shall be affixed to each disk submitted. The label shall indicate the type of schedule (Initial, Update, or Change), full contract number, project name, project location, data date, name and telephone number or person responsible for the schedule, and the version used to prepare the C.P.M.

3.5.1.3 File Name

Each file submitted shall have a name related to either the schedule data date, project name, or contract number. The Contractor shall develop a naming convention that will ensure that the names of the files submitted are unique. The Contractor shall submit the file naming convention to the Contracting Officer for approval.

3.5.2 Narrative Report

A Narrative Report shall be provided with each update of the project schedule. This report shall be provided as the basis of the Contractor's progress payment request. The Narrative Report shall include: a description of activities along the critical path, a description of current and anticipated problem areas or delaying factors and their impact, and an explanation of corrective actions taken or required to be taken. The narrative report is expected to relay to the Government, the Contractor's thorough analysis of the schedule output and its plans to compensate for any problems, either current or potential, which are revealed through that analysis.

3.5.3 Approved Changes Verification

Only project schedule changes that have been previously approved by the Contracting Officer shall be included in the schedule submission. The Narrative Report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes.

3.5.4 Schedule Reports

The format for each activity for the schedule reports listed below shall contain: Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float. Actual Start and Actual Finish Dates shall be printed for those activities in-progress or completed.

3.5.4.1 Activity Report

A list of all activities sorted according to activity number. For completed activities the Actual Start Date shall be used as the secondary sort.

3.5.4.2 Logic Report

A list of Preceding and Succeeding activities for every activity in ascending order by activity number and then sorted according to Early Start Date. For completed activities the Actual Start Date shall be used as the secondary sort. Preceding and succeeding activities shall include all information listed above in paragraph Schedule Reports. A blank line shall be left between each activity grouping.

3.5.4.3 Total Float Report

A list of all activities sorted in ascending order of total float. Activities which have the same amount of total float shall be listed in ascending order of Early Start Dates. Completed activities shall not be shown on this report.

3.5.4.4 Earnings Report

A compilation of the Contractor's Total Earnings on the project from the Notice to Proceed until the most recent Monthly Progress Meeting. This report shall reflect the Earnings of specific activities based on the agreements made in the field and approved between the Contractor and Contracting Officer at the most recent Monthly Progress Meeting. Provided that the Contractor has provided a complete schedule update, this report shall serve as the basis of determining Contractor Payment. Activities shall be grouped by bid item and sorted by activity numbers. This report shall: sum all activities in a bid item and provide a bid item percent; complete and sum all bid items to provide a total project percent complete.

The printed report shall contain, for each activity: Activity Number, Activity Description, Original Budgeted Amount, Total Quantity, Quantity to Date, Percent Complete (based on cost), Earnings to Date.

3.5.4.5 Cash Flow Report

A report showing scheduled cost of work-in-place by week (tabular report) and a cash flow curve by week (S-curve plot), both based on early dates.

3.5.5 Network Diagram

The time scaled network diagram shall be required on the initial schedule submission and on quarterly update submissions. The network diagram shall depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

3.5.5.1 Continuous Flow

Diagrams shall show a continuous flow from left to right with no arrows from right to left. The activity or event number, description, duration, and estimated earned value shall be shown on the diagram.

3.5.5.2 Project Milestone Dates

Dates shall be shown on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

3.5.5.3 Critical Path

The critical path shall be clearly shown.

3.5.5.4 Banding

Activities shall be grouped to assist in the understanding of the activity sequence. Typically, this flow will group activities by category of work, work area and/or responsibility.

3.5.5.5 S-Curves

Earnings curves shall be provided showing projected early and late earnings and earnings to date.

3.6 PERIODIC PROGRESS MEETINGS

Progress meetings to discuss payment shall include a monthly on-site meeting or other regular intervals mutually agreed to at the preconstruction conference. During this meeting the Contractor will describe, on an activity by activity basis, all proposed revisions and adjustments to the project schedule required to reflect the current status of the project. The Contracting Officer will approve activity progress, proposed revisions, and adjustments as appropriate.

3.6.1 Meeting Attendance

The Contractor's Project Manager and Scheduler shall attend the regular progress meeting.

3.6.2 Update Submission Following Progress Meeting

A complete update of the project schedule containing all approved progress, revisions, and adjustments, based on the regular progress meeting, shall be submitted not later than 4 working days after the monthly progress meeting.

3.6.3 Progress Meeting Contents

Update information, including Actual Start Dates, Actual Finish Dates, Remaining Durations, and Cost to Date shall be subject to the approval of the Contracting Officer. The following minimum set of items which the Contractor shall address, on an activity by activity basis, during each progress meeting.

3.6.3.1 Start and Finish Dates

The Actual Start and Actual Finish dates for each activity currently in-progress or completed activities.

3.6.3.2 Time Completion

The estimated Remaining Duration for each activity in-progress. Time-based progress calculations must be based on Remaining Duration for each activity.

3.6.3.3 Cost Completion

The earnings for each activity started. Payment shall be based on earnings for each in-progress or completed activity. Payment for individual activities shall not be made for work that contains quality defects. A portion of the overall project amount may be retained based on delays of activities.

3.6.3.4 Logic Changes

All logic changes pertaining to Notice to Proceed on change orders, change orders to be incorporated into the schedule, contractor proposed changes in work sequence, corrections to schedule logic for out-of-sequence progress, lag durations, and other changes that have been made pursuant to contract provisions shall be specifically identified and discussed.

3.6.3.5 Other Changes

Other changes required due to delays in completion of any activity or group of activities are those delays beyond the Contractors control such as strikes and unusual weather. Also included are delays encountered due to submittals, Government Activities, deliveries or work stoppage which makes re-planning the work necessary, and when the schedule does not represent the actual prosecution and progress of the work.

3.7 REQUESTS FOR TIME EXTENSIONS

In the event the Contractor requests an extension of the contract completion date, he shall furnish such justification, project schedule data and supporting evidence as the Contracting Officer may deem necessary for a determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof of delay, based on revised activity logic, duration, and costs (updated to the specific date that the delay occurred) is obligatory to any approvals.

3.7.1 Justification of Delay

The project schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved with this request.

The Contracting Officer's determination as to the number of allowable days of contract extension, shall be based upon the project schedule updates in effect for the time period in question and other factual information. Actual delays that are found to be caused by the Contractor's own actions, which result in the extension of the schedule, shall not be a cause for a time extension to the contract completion date.

3.7.2 Submission Requirements

The Contractor shall submit a justification for each request for a change in the contract completion date of under two weeks based upon the most recent schedule update at the time of the Notice to Proceed or constructive direction issued for the change. Such a request shall be in accordance

with the requirements of other appropriate Contract Clauses and shall include, as a minimum:

- a. A list of affected activities, with their associated project schedule activity number.
- b. A brief explanation of the causes of the change.
- c. An analysis of the overall impact of the changes proposed.
- d. A sub-network of the affected area.

Activities impacted in each justification for change shall be identified by a unique activity code contained in the required data file.

3.7.3 Additional Submission Requirements

For any request for time extension for over 2 weeks, the Contracting Officer may request an interim update with revised activities for a specific change request. The Contractor shall provide this disk within 4 days of the Contracting Officer's request.

3.8 DIRECTED CHANGES

If Notice to Proceed (NTP) is issued for changes prior to settlement of price and/or time, the Contractor shall submit proposed schedule revisions to the Contracting Officer within 2 weeks of the NTP being issued. The proposed revisions to the schedule will be approved by the Contracting Officer prior to inclusion of those changes within the project schedule. If the Contractor fails to submit the proposed revisions, the Contracting Officer may furnish the Contractor suggested revisions to the project schedule. The Contractor shall include these revisions in the project schedule until the Contractor submits revisions, and final changes and impacts have been negotiated. If the Contractor has any objections to the revisions furnished by the Contracting Officer, then the Contractor shall advise the Contracting Officer within 2 weeks of receipt of the revisions. Regardless of the objections, the Contractor will continue to update their schedule with the Contracting Officer's revisions until a mutual agreement in the revisions may be made. If the Contractor fails to submit alternative revisions within 2 weeks of receipt of the Contracting Officer's proposed revisions, the Contractor will be deemed to have concurred with the Contracting Officer's proposed revisions. The proposed revisions will then be the basis for an equitable adjustment for performance of the work.

3.9 OWNERSHIP OF FLOAT

Float available in the schedule, at any time, shall not be considered for the exclusive use of either the Government or the Contractor.

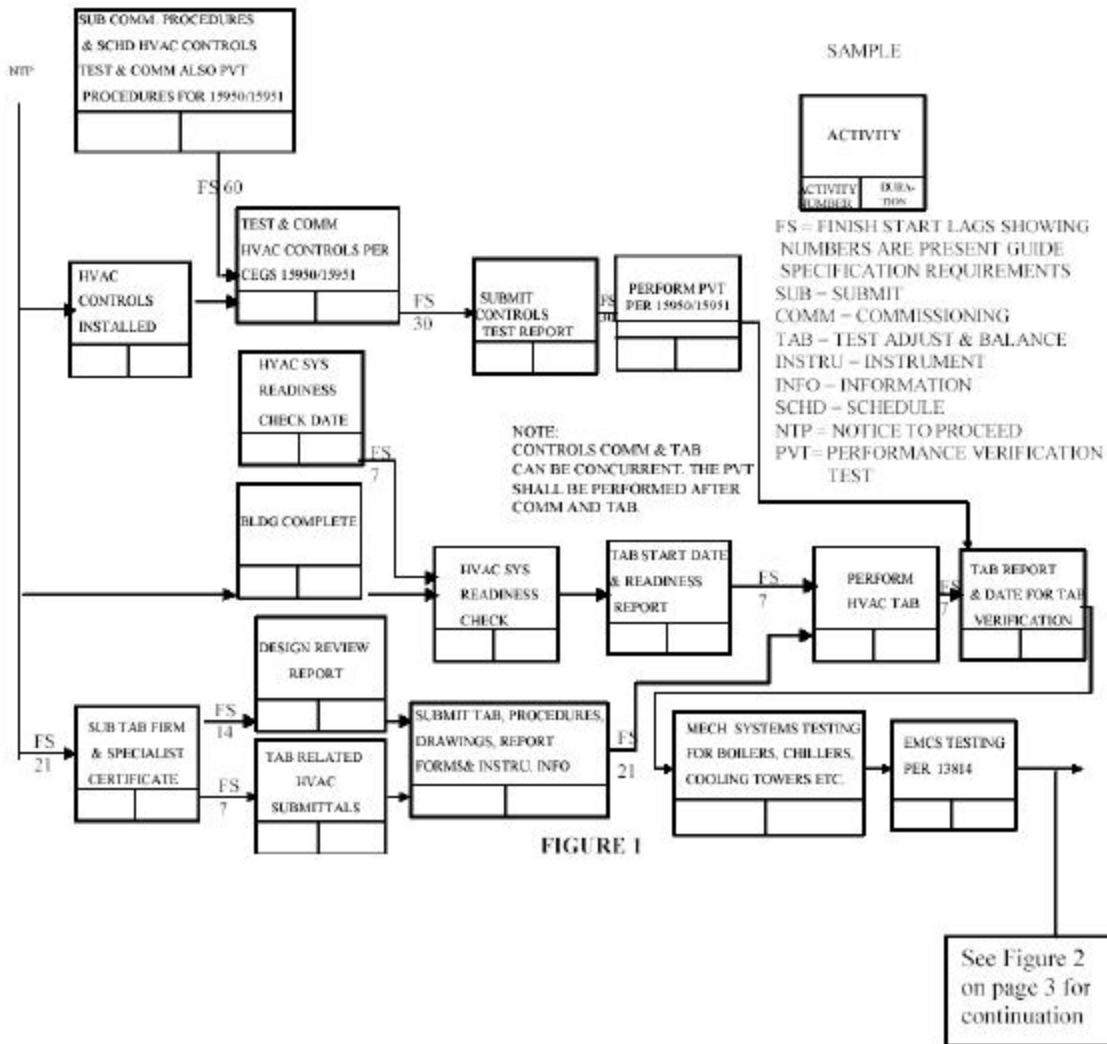
3.10 NAS DATA

The Contractor shall provide the Government with the means to electronically transfer all required NAS data into the Resident Management

System (RMS) program using the Standard Data Exchange Format (SDEF). The Contractor may use network analysis software different from that used by the Contracting Officer in the Resident Office, however, the Contractor shall also furnish the following:

NAS data that complies with the Standard Data Exchange Format (SDEF). This is a standard ASCII format for exchanging scheduling data and is compatible with our resident management system. Many software developers provide the capability to convert and export schedule data to the SDEF at no additional cost. The SDEF specifications are in a separate publication, available from the Internet <http://www.usace.army.mil/search.html> - Publications.

-- End of Section --



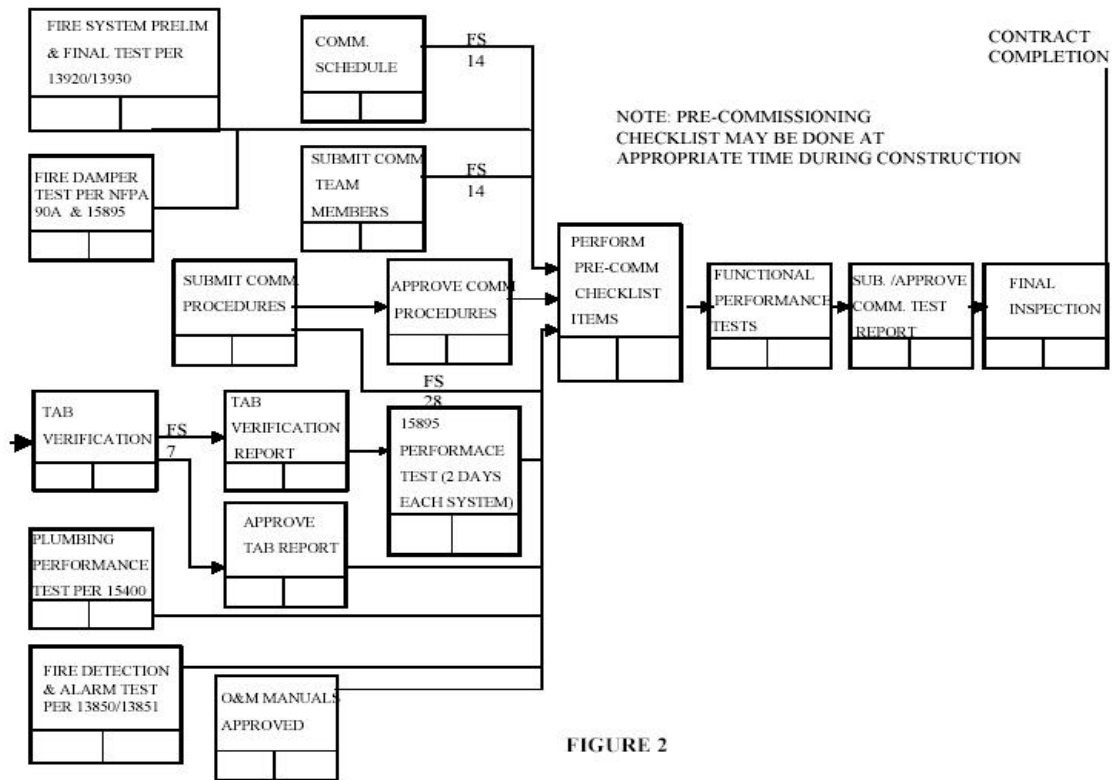


FIGURE 2

END OF SECTION

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SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures:"

SD-01 Preconstruction Submittals

Final Submittal Register 4288; G

1.2 CONTROL AND SCHEDULING OF SUBMITTALS

1.2.1 Submittal Coordination Meeting

After the preconstruction conference and before any submittals are sent to the Contracting Officer's Representative (COR), the Contractor shall meet with the COR and provide and further develop the preliminary submittal register, ENG Form 4288, attached to the end of this section. The Government will provide a suitable electronic copy for import to the RMS system prior to the submittal coordination meeting. During the meeting all required items will be identified and grouped into three categories:

•Government Approved (G)

Government approval is required for extensions of design, critical materials, variations/deviations, an "or equal" decision, equipment whose compatibility with the entire system must be checked, architectural items such as Color Charts/Patterns/Textures, and other items as designated by the COR. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," these submittals will be acted on as "shop drawings."

•For Information Only (FIO)

Submittals not requiring Government approval, but require submission, will be for information only. These are items such as Installation Procedures, Certificates of compliance, Samples, Qualifications, etc. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," these submittals will not be acted on as "shop drawings."

•For Contractor Only (KIO)

Those items that can be visually inspected by the Contractor's Quality Control Representative (CQC) on site or are provided to the Government other than with an ENG Form 4025: The items that fall into this category shall not be included on the register and shall not be submitted to the COR. For these items, the contractor shall maintain a

separate method of tracking and make them available at the appropriate preparatory inspection(s).

1.2.2 Final Submittal Register

The final submittal register shall be coordinated with the progress schedule and submitted within 40 days of Notice to Proceed. In preparing the final document, adequate time (minimum of 30 days) shall be allowed for review and approval, and possible resubmittal of each item on the register.

1.2.3 Submittal Register Updates

The Contractor's quality control representative shall review the listing at least every 30 days and take appropriate action to maintain an effective system. Copies of updated or corrected listings shall be submitted to the COR at least every 30 days in the quantity specified.

1.3 SUBMITTAL TYPES

Throughout these specifications submittals may be identified with the prefix "SD" (submittal data) followed by a number (category, i.e., data, drawings, reports, etc.). This is for bookkeeping and record sorting in the system:

SD-01 Preconstruction Submittals

Certificates of insurance.
Surety bonds.
List of proposed subcontractors.
List of proposed products.
Construction Progress Schedule.
Submittal register.
Schedule of values.
Health and safety plan.
Work plan.
Quality control plan.
Environmental protection plan.

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and

other characteristics of materials or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

SD-05 Design Data

Calculations, mix designs, analyses or other data pertaining to a part of work.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must have been within three years of date of contract award for the project.)

Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports

Daily checklists

Final acceptance test and operational test procedure

SD-07 Certificates

Statements printed on the manufacturer's letterhead, signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly

name the project.

Document required of Contractor, or of a supplier, installer or subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications. Confined space entry permits.

Confined space entry permits.

Text of posted operating instructions.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and Material Safety Data sheets concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

Factory test reports.

SD-10 Operation and Maintenance Data

Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

1.4 FORMAT OF SUBMITTALS

1.4.1 Transmittal Form

Transmit each submittal, except sample installations and sample panels, to office of approving authority. Transmit submittals with transmittal form prescribed by Contracting Officer and standard for project. The transmittal form shall identify Contractor, indicate date of submittal, and include information prescribed by transmittal form and required in paragraph entitled "Identifying Submittals." Process transmittal forms to record actions regarding sample panels and sample installations.

1.4.2 Identifying Submittals

Identify submittals, except sample panel and sample installation, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy

of each submittal identically, with the following:

- a. Project title and location.
- b. Construction contract number.
- c. Section number of the specification section by which submittal is required.
- d. Submittal description (SD) number of each component of submittal.
- e. When a resubmission, add alphabetic suffix on submittal description, for example, SD-10A, to indicate resubmission.
- f. Name, address, and telephone number of subcontractor, supplier, manufacturer and any other second tier Contractor associated with submittal.
- g. Product identification and location in project.

1.4.3 Format for SD-02 Shop Drawings

- a. Shop drawings shall not be less than A4 (297 by 210 mm) (8 1/2 by 11 inches) nor more than AO (1189 by 841 mm) (30 by 42 inches).
- b. Present A4 (297 by 210 mm) (8 1/2 by 11 inches) sized shop drawings as part of the bound volume for submittals required by section. Present larger drawings in sets.
- c. Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph entitled "Identifying Submittals."
- d. Dimension drawings, except diagrams and schematic drawings; prepare drawings demonstrating interface with other trades to scale. Shop drawing dimensions shall be the same unit of measure as indicated on the contract drawings. Identify materials and products for work shown.
- e. Drawings shall include the nameplate data, size and capacity. Also include applicable federal, military, industry and technical society publication references.

1.4.4 Format of SD-03 Product Data and SD-08 Manufacturer's Instructions

- a. Present product data submittals for each section as a complete, bound volume. Include table of contents, listing page and catalog item numbers for product data.
- b. Indicate, by prominent notation, each product which is being submitted; indicate specification section number and paragraph number to which it pertains.
- c. Supplement product data with material prepared for project to satisfy submittal requirements for which product data does not exist.

Identify this material as developed specifically for project, with information and format as required for submission of SD-07 Certificates..

d. Provide product data in metric dimensions. Where product data are included in preprinted catalogs with English units only, submit metric dimensions on separate sheet.

e. Product data shall include the manufacturer's name, trade name, place of manufacture, and catalog model or number. Submittals shall also include applicable federal, military, industry and technical society publication references. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified for SD-07 Certificates.

f. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), and Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

g. Submit manufacturer's instruction prior to installation.

1.4.5 Format of SD-04 Samples

a. Furnish samples in sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately same size as specified:

(1) Sample of Equipment or Device: Full size.

(2) Sample of Materials Less Than 50 by 75 mm(2 by 3 inches):
Built up to A4 (297 by 210 mm) (8 1/2 by 11 inches).

(3) Sample of Materials Exceeding A4 (297 by 210 mm) (8 1/2 by 11 inches): Cut down to A4 (297 by 210 mm) (8 1/2 by 11 inches) and adequate to indicate color, texture, and material variations.

(4) Sample of Linear Devices or Materials: 250 mm(10 inch) length or length to be supplied, if less than 250 mm(10 inches). Examples of linear devices or materials are conduit and handrails.

(5) Sample of Non-Solid Materials: 750 ml(Pint). Examples of non-solid materials are sand and paint.

(6) Color Selection Samples: 50 by 100 mm(2 by 4 inches).

(7) Sample Panel: 1200 by 1200 mm(4 by 4 feet).

(8) Sample Installation: 10 square meters(100 square feet).

b. Samples Showing Range of Variation: Where variations are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range.

c. Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples shall be in undamaged condition at time of use.

d. Recording of Sample Installation: Note and preserve the notation of area constituting sample installation but remove notation at final clean up of project.

e. When color, texture or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.4.6 Format of SD-05 Design Data and SD-07 Certificates

Provide design data and certificates on 297 by 210 mm (8 1/2 by 11 inches) paper. Provide a bound volume for submittals containing numerous pages.

1.4.7 Format of SD-06 Test Reports and SD-09 Manufacturer's Field Reports

a. Provide reports on 297 by 210 mm (8 1/2 by 11 inches) paper in a complete bound volume.

b. Indicate by prominent notation, each report in the submittal. Indicate specification number and paragraph number to which it pertains.

1.4.8 Format of SD-10 Operation and Maintenance (O&M) Data

O&M Data format shall comply with the requirements specified in Section 01701, Operation and Maintenance Data"

1.4.9 Format of SD-01 Preconstruction Submittals and SD-11 Closeout Submittalss

a. When submittal includes a document which is to be used in project or become part of project record, other than as a submittal, do not apply Contractor's approval stamp to document, but to a separate sheet accompanying document.

b. Provide all dimensions in administrative submittals in metric. Where data are included in preprinted material with English units only, submit metric dimensions on separate sheet.

1.5 APPROVED SUBMITTALS

The approval of submittals by the COR shall not be construed as a complete check, but will indicate only that the general method of construction,

materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist. The Contractor, under the CQC requirements of this contract, is responsible for the dimensions and design of adequate connections, details, and satisfactory construction of all work. After submittals have been approved by the COR, no resubmittal for the purpose of substituting materials or equipment will be given consideration.

1.6 DISAPPROVED SUBMITTALS

The Contractor shall make all corrections required by the COR and promptly furnish a corrected submittal in the format and number of copies specified for the initial submittal. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, written notice, as required under the Contract Clause entitled "Changes," shall be given to the COR.

1.7 PAYMENT

Separate payment will not be made for submittals, and all costs associated therein shall be included in the applicable unit prices or lump sum prices contained in the schedule. Payment will not be made for any material or equipment which does not comply with contract requirements.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL

Prior to submittal, all items shall be checked and approved by the Contractor's CQC and each item of the submittal shall be stamped, signed, and dated. Each respective transmittal form (ENG Form 4025) shall be signed and dated by the CQC certifying that the accompanying submittal complies with the contract requirements. This procedure applies to all submittals. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including, but not limited to, catalog cuts, diagrams; operating charts or curves; test reports; test cylinders; samples; O&M manuals including parts lists; certifications; warranties and other such required items. Units of weights and measures used on all submittals shall be the same as the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Government-approval submittals shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. The COR may request submittals in addition to those listed when deemed necessary to adequately describe the work covered in the respective sections. The Contractor shall maintain a complete and up-to-date file of all submittals/items on site for use by both the Contractor and the Government.

3.2 SUBMITTAL REGISTER (ENG Form 4288)

An electronic copy of the submittal register - ENG Form 4288 - for Divisions 1 through 16 in a format compatible for import into RMS will be

provided by the Government and a hard copy shall be further developed by the Contractor prior to the submittal coordination meeting and list each item of equipment and material for which submittals are required in the Technical Specifications. (See paragraph SUBMITTALS at the beginning of each specification section.) The Contractor shall approve all items listed on the submittal register. During the submittal coordination meeting, a preliminary submittal register will be created by annotating this Form 4288. When the final submittal register is submitted for approval, the Contractor shall complete the column entitled "Item No." and all data under "Contractor Schedule Dates" and return five completed copies to the COR for approval. The Contractor shall review the list to ensure its completeness and may expand general category listings to show individual entries for each item. The numbers in column "Item No." are to be assigned sequentially starting with "1" for each specification section. DO NOT preassign transmittal numbers when preparing the submittal register. When a conflict exists between the submittal register and a submittal requirement in the technical sections, other than those submittals referenced in Paragraph 3.9: Field Test Reports, the approved submittal register shall govern. The preliminary, and then the final approved submittal register, will become the scheduling documents and will be updated monthly and used to control submittals throughout the life of the contract. Names and titles of individuals authorized by the Contractor to approve shop drawings shall be submitted to COR with the final 4288 form. Supplier or subcontractors certifications are not acceptable as meeting this requirement.

3.3 SCHEDULING

Submittals covering component items forming a system, or items that are interrelated, shall be coordinated and submitted concurrently. Certifications shall be submitted together with other pertinent information and/or drawings. Additional processing time beyond 30 days, or number of copies, may be shown by the COR on the submittal register attached in the "Remarks" column, or may be added by the COR during the coordination meeting. No delays damages or time extensions will be allowed for time lost due to the Contractor not properly scheduling and providing submittals.

3.4 TRANSMITTAL FORM (ENG Form 4025)

Transmittal Form 4025 (sample at end of this section) shall be used for submitting both Government-approval and information-only submittals in accordance with the instructions on the reverse side of the form. Transmittal numbers shall be assigned sequentially. Electronic generated 4025 forms shall be printed on carbonless paper and be a reasonable facsimile of the original 4025. If electronic forms are not used, the original 4025 forms shall be used (do not photo copy) and will be furnished by the COR. These forms shall be filled in completely prior to submittal. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.. Each submittal item shall be listed separately on the form, naming subcontractor, supplier, or manufacturer, applicable specification paragraph number(s), drawing/sheet number, pay item number, and any other information needed to identify the item, define its use, and locate it in the work. One or more 4025 forms may be used per specification section, however, DO NOT include more than

one specification section per transmittal.

3.5 CROSS-REFERENCE (ENG FORM 4288/ENG FORM 4025)

To provide a cross-reference between the approved submittal register and transmittal forms, the Contractor shall record the "transmittal numbers" assigned when submitting items in column "Transmittal No." of the ENG FORM 4288. The item numbers in column "Item No." of submittal register shall correspond to the item numbers on ENG Form 4025.

3.6 SUBMITTAL PROCEDURE

3.6.1 General

Shop drawings with 4025 forms shall be submitted in the number of copies specified in subparagraphs "Government Approved Submittals" and "Information Only Submittals," or as indicated on the submittal register in the "Remarks" column. Submit a complete collated "reviewers copy" with one 4025 form and attachments (not originals). The remaining copies (4 for Government-approval, 2 for information-only) of 4025 forms and attachments shall not be collated. This would not apply to a series of drawings.

3.6.2 Approval of Submittals by the Contractor

Before submittal to the COR, the Contractor shall review and correct shop drawings prepared by subcontractors, suppliers, and itself, for completeness and compliance with plans and specifications. The Contractor shall not use red markings for correcting material to be submitted. Red markings are reserved for COR's use. Approval by the Contractor shall be indicated on each shop drawing by an approval stamp containing information as shown in this section. Submittals not conforming to the requirements of this section will be returned to the Contractor for correction and resubmittal.

3.6.3 Variations

For submittals which include proposed variations requested by the Contractor, column "h" of ENG Form 4025 shall be checked and the submittal shall be classified as G, and submitted accordingly. The Contractor shall set forth in writing the justification for any variations and annotate such variations on the transmittal form in the REMARKS block. Variations are not approved unless there is an advantage to the Government. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted variations.

3.6.4 Drawings

Each drawing shall be not larger than A1 size (841 mm wide by 594 mm high), with a title block in lower right hand corner and a 75 mm by 100 mm (3 by 4 inch) clear area adjacent. The title block shall contain the subcontractor's or fabricator's name, contract number, description of item(s), bid item number, and a revision block. Provide a blank margin of 20 mm (3/4 inch) at bottom, 50 mm (2 inches) at left, and 10 mm (1/2 inch) at top and right. Where drawings are submitted for assemblies of more than

one piece of equipment or systems of components dependent on each other for compatible characteristics, complete information shall be submitted on all such related components at the same time. The Contractor shall ensure that information is complete and that sequence of drawing submittal is such that all information is available for reviewing each drawing. Drawings for all items and equipment, of special manufacture or fabrication, shall consist of complete assembly and detail drawings. All revisions after initial submittal shall be shown by number, date, and subject in revision block.

3.6.4.1 Submittals Containing Drawings Larger than A3 size, (297 mm high by 420 mm wide)

For Government-approval submittals containing drawings larger than A3 size, one reproducible and one blue line copy will be required to be submitted with five copies of the ENG Form 4025. The marked-up reproducible (and/or any review comments contained on the page-size comment sheet(s) at the Government's option) will be returned to the Contractor upon review. The Contractor shall provide three copies of blue line drawings (generated from the reviewed reproducible) to the Government within 10 days of Contractor's receipt of the reviewed reproducible. The Contractor shall not incorporate approved work into the project until the Government has received the three blue line copies. The Contractor shall use the marked-up reproducible to make any additional copies as needed. For information-only submittals, one reproducible and two blue line copies shall be submitted with the appropriate number of copies of ENG Form 4025.

3.6.5 Printed Material

All requirements for shop drawings shall apply to catalog cuts, illustrations, printed specifications, or other data submitted, except that the 75 mm by 100 mm (3 inch by 4 inch) clear area adjacent to the title block is not mandatory. Inapplicable portions shall be marked out and applicable items such as model numbers, sizes, and accessories shall be indicated by arrow or highlighted.

3.7 SAMPLES REQUIRING LABORATORY ANALYSIS

See Section 01451 CONTRACTOR QUALITY CONTROL for procedures and address for samples requiring Government testing.

3.8 SAMPLES REQUIRING VISUAL INSPECTION

Samples requiring only physical inspection for appearance and suitability shall be coordinated with the on-site Government quality assurance representative (QAR).

3.9 FIELD TEST REPORTS

Routine tests such as soil density, concrete deliveries, repetitive pressure testing shall be delivered to the QAR with the daily Quality Control reports. See SECTION: 01451 CONTRACTOR QUALITY CONTROL.

3.10 CONTROL OF SUBMITTALS

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

3.11 GOVERNMENT APPROVED SUBMITTALS (G)

The Contractor shall submit 5 copies of G submittals with 5 corresponding 4025 forms. Upon completion of G submittal review, copies as specified below will be marked with an action code, dated, and returned to the Contractor. See "Drawings" above for special instructions if drawings larger than size A3 (11 inch by 17 inch) are used.

3.11.1 Processing of G Submittals

Submittals will be reviewed and processed as follows:

- a. Approved as Submitted (Action Code "A"): Shop drawings which can be approved without correction will be stamped "Approved" and two copies will be returned to the Contractor. No resubmittal required.
- b. Approved Except as Noted (Action Code "B"): Shop drawings which have only minor discrepancies will be annotated in red to indicate necessary corrections. Marked material will be stamped "Approved Except as Noted" and two copies returned to the Contractor for correction. No resubmittal required.
- c. Approved Except as Noted (Action Code "C"): Shop drawings which are incomplete or require more than minor corrections will be annotated in red to indicate necessary corrections. Marked material will be stamped "Approved Except as Noted - Resubmission Required" and two copies returned to the Contractor for correction. Resubmittal of only those items needing correction required.
- d. Disapproved (Action Code "E"): Shop drawings which are fundamentally in error, cover wrong equipment or construction, or require extensive corrections, will be returned to the Contractor stamped "Disapproved." An explanation will be furnished on the submitted material or on ENG Form 4025 indicating reason for disapproval. Complete resubmittal required.
- e. Resubmittal will not be required for shop drawings stamped "A" or "B" unless subsequent changes are made by Contractor or a contract modification. For shop drawings stamped "C" or "E," Contractor shall make corrections required, note any changes by dating the revisions to correspond with the change request date, and promptly resubmit the corrected material. Resubmittals shall be associated with the "parent" by use of sequential alpha characters (for example, resubmittal of transmittal 8 will be 8A, 8B, etc). Government costs incurred after the first resubmittal may be charged to the Contractor.

3.12 INFORMATION ONLY SUBMITTALS

The Contractor shall submit three copies of data and four copies of ENG Form 4025. Information-only submittals will not be returned. Government

approval is not required on information-only submittals. These submittals will be used for information purposes. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the Contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications and will not prevent the COR from requiring removal and replacement if nonconforming material is incorporated in the work. This does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or check testing by the Government in those instances where the technical specifications so prescribe.

3.12.1 Processing of Information-Only Submittals

Information-only submittals shall be submitted prior to delivery of the material or equipment to the job site. ENG Form 4025 shall be marked with the words "contractor approved - information copy only" in the REMARKS block of the form. Submittals will be monitored and spot checks made. When such checks indicate noncompliance, the Contractor will be notified by the same method used for Government-approval submittals. Resubmittal of nonconforming information-only submittals shall be reclassified Government-approval and shall be in five copies.

3.13 CONTRACTOR APPROVAL STAMP

The stamp used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following:

CONTRACTOR: _____		
CONTRACT NUMBER _____		
TRANSMITTAL NUMBER _____		
ITEM NUMBER _____		
SPECIFICATION SECTION _____		
PARAGRAPH NUMBER _____		
_____ APPROVED AS SUBMITTED		
_____ APPROVED WITH CORRECTIONS AS NOTED		
SIGNATURE: _____		
TITLE: _____		DATE _____

-- End of Section --

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01001	SD-01 Preconstruction Submittals														
			Safety Plan		G												
			Mechanical Electrical Layout														
			Drawings														
			SD-10 Operation and Maintenance														
			Data														
			Audio-Video Recordings	1.6	G												
		01320	SD-07 Certificates														
			Preliminary project schedule, two		G												
			(2) copies														
			initial project schedule, two (2)		G												
			copies														
			Periodic schedules updates,														
			monthly updates two (2) copies														
			SD-08 Manufacturer's Instructions														
			Qualifications		G												
		01330	SD-01 Preconstruction Submittals														
			Final Submittal Register 4288		G												
		01352	SD-01 Preconstruction Submittals														
			statement														
			SD-03 Product Data														
			Product Data for plumbing fixtures														
			Product Data for new HVAC														
			equipment														
			Product Data and wiring														
			diagrams														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01352	'LEED Construction Waste Management Plan'														
			Product Data and certification letter														
			Product Data indicating location														
			Product Data for FSC certified wood														
			Product Data and Shop Drawings for carbon dioxide monitoring system														
			Product Data for adhesives and sealants used on the interior of the building														
			Product Data for paints and coatings														
			Product Data for carpet products														
			Product Data for composite wood and agrifiber products														
			Contractor to submit name of the LEED accredited professional														
		01702	SD-01 Preconstruction Submittals														
			Red Line Drawings		G												
		01703	SD-01 Preconstruction Submittals														
			Equipment Warranty Identification		G												
			Tag Schedule														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION Corrosion Control/AGE, Malmstrom AFB						CONTRACTOR											
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
		01703	Equipment Identification		G												
			Nameplate Schedule														
		02220	SD-07 Certificates														
			Demolition plan		G												
			Notifications	1.4.1	G												
			SD-11 Closeout Submittals														
			Receipts														
		02231	SD-03 Product Data														
			Nonsaleable Materials	3.6.1	G												
			SD-04 Samples														
			Tree wound paint	2.1													
			Herbicide	2.2													
		02300	SD-03 Product Data														
			Utilization of Excavated Materials	3.9	G												
			Rock Excavation	1.5.2													
			Opening of any Excavation or	3.4													
			Borrow Pit														
			Shoulder Construction	3.15													
			SD-06 Test Reports														
			Testing	3.18													
			Borrow Site Testing	2.1													
			SD-07 Certificates														
			Testing	3.18													
		02312	SD-01 Preconstruction Submittals														
			Records of Existing Conditions	1.6													
			Location of Underground Utilities	1.6													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF A C T I O N	DATE RCD FROM CONTR	DATE FWD TO APPR AUTH/ TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF A C T I O N
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02312	Location of Approved Utilities	1.6													
			Location of Test	1.6													
			Location of Inspection	1.6													
			SD-02 Shop Drawings														
			As-Built Drawings	1.5													
			Drawings	1.5													
			SD-06 Test Reports														
			Soil Test	3.13													
			SD-07 Certificates														
			Demolition Plan	1.4													
			Work Plan	1.4													
			Protection Plan	1.4													
			Proposed Soil Materials	2.2.1													
			Compost														
		02315	SD-01 Preconstruction Submittals														
			Construction Equipment List	1.6													
			Underground Utilities	1.7													
			Underground Utilities	3.1													
			Location of Inspections	1.7													
			Location of Testing	1.7													
			Location of Utility Approvals	1.7													
			SD-06 Test Reports														
			Soil Test	1.5													
			SD-07 Certificates														
			Compost														
		02473	SD-01 Preconstruction Submittals														

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CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
		02473	Construction Equipment List	1.8													
			SD-02 Shop Drawings														
			Shoring	1.9													
			Bracing	1.9													
			Steel Casing	1.9													
			Safety Tubes	1.9													
			Reinforcing Steel Details	1.9													
			Dowels and Anchor Bolts	1.9													
			SD-03 Product Data														
			Construction Equipment List	1.8													
			SD-06 Test Reports														
			Test report	3.4													
			Gas Protection	1.6.3													
			Concrete Test	3.4													
			Daily Progress Report	1.4													
			Drilling Record for Each Pier	1.4													
			Record of Gas Readings	1.6.3													
			Inspection Notices	3.1.5													
			SD-07 Certificates														
			Listing of Product Installations	1.10													
			Gas Protection	1.6.3													
			Safety Provisions	1.6													
		02515	SD-02 Shop Drawings														
			Erection/Installation Drawings	1.4													
			As-Built Drawings	1.4													
			SD-03 Product Data														

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Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E	DATE OF ACTION	DATE OF ACTION	DATE OF ACTION				
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	SUBMIT (g)	BY (h)	BY (i)	(j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)	DATE OF ACTION (p)	DATE RCD FRM APPR (q)	REMARKS (r)
		02515	Cast-Iron/Ductile-Iron Pipe	2.1.1													
			Pipe Connections	2.1.2													
			Pipe Connections	3.5													
			Pipe Connections	3.7													
			Rubber Gaskets	2.1.3													
			Rubber Gaskets	3.1													
			Rubber Gaskets	3.6													
			Plastic Pipe and Fittings	2.1.4													
			Gate Valves	2.2.1													
			Gate Valves	3.8													
			Tees	2.1.4													
			Tees	2.3.1													
			Corporation-Type Stops	3.8													
			Service Stops	2.3.3													
			Service Stops	3.8													
			Service Boxes	2.3.4													
			SD-06 Test Reports														
			Hydrostatic Test	3.11.1													
			Pressure Test	3.11.2													
			Leakage Test	3.11.3													
			Sterilizing	3.11.6													
			SD-08 Manufacturer's Instructions														
			Pipe Connections	2.1.2													
			Pipe Connections	3.5													
			Pipe Connections	3.7													
			Rubber Gaskets	2.1.3													

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TITLE AND LOCATION Corrosion Control/AGE, Malmstrom AFB						CONTRACTOR											
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
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(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02515	Rubber Gaskets	3.1													
			Rubber Gaskets	3.6													
			Plastic Pipe and Fittings	2.1.4													
			Gate Valves	2.2.1													
			Gate Valves	3.8													
			Tees	2.1.4													
			Tees	2.3.1													
			Corporation Stops	2.3.2													
			Service Stops	2.3.3													
			Service Stops	3.8													
			Service Boxes	2.3.4													
		02536	SD-01 Preconstruction Submittals														
			Existing Conditions	1.4													
			SD-02 Shop Drawings														
			As-Built Drawings	1.3													
			SD-06 Test Reports														
			Test Reports	2.8													
			Inspection Reports	2.8													
			SD-07 Certificates														
			Concrete Aggregates	2.1													
			Portland Cement	2.4													
			Rubber Gaskets	2.2													
			Pipe	2.3													
			Frames and Covers	2.5													
		02555	SD-02 Shop Drawings														
			Installation Drawings	1.6													

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TITLE AND LOCATION Corrosion Control/AGE, Malmstrom AFB						CONTRACTOR											
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/		
						SUBMIT	BY	MATERIAL NEEDED	A C T I O N C O D E	DATE OF A C T I O N		DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			A C T I O N C O D E
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02555	SD-03 Product Data														
			Plastic Pipe and Fittings	2.2													
			Protective Systems														
			SD-06 Test Reports														
			Inspection Reports	3.8													
			Quality Control	1.7													
			SD-08 Manufacturer's Instructions														
			Manufacturer's Instructions	1.8													
			Posted Instructions														
		02635	SD-02 Shop Drawings														
			Coordination Drawings														
			SD-03 Product Data														
			Frames, Covers and Gratings	2.3													
			Precast Concrete Manholes	2.4													
			Precast Concrete Base Sections	2.4													
			Concrete Block														
			Bituminous Coating	2.1.1													
			Cold Bituminous Mastic Sealer	2.1.1													
			SD-06 Test Reports														
			Infiltration Test	3.7.1.1													
			Exfiltration Test	3.7.1.1													
			Hydrostatic Test	3.7.1.2													
		02745	SD-03 Product Data														
			Asphalt Cement	2.3													
			Bituminous Concrete	2.2													
			Bituminous Prime Coat														

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Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
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		02745	Bituminous Tack Coat														
			Paint	2.7.1													
			Reflective Beads	2.7.2													
			Subbase and Base Course	2.1													
			SD-05 Design Data														
			Job-Mix Formula	2.6													
			SD-06 Test Reports														
			test report	1.6.3													
			SD-07 Certificates														
			Asphalt Cement	2.3													
			Bituminous Concrete	2.2													
			Bituminous Prime Coat														
			Bituminous Tack Coat														
			Paint	2.7.1													
			Reflective Beads	2.7.2													
			Subbase and Base Course	2.1													
		02755	SD-01 Preconstruction Submittals														
			Construction Equipment List	1.8													
			Daily Activity Report	3.1.1													
			SD-02 Shop Drawings														
			Fabrication Drawings	1.9													
			Reinforcing Steel	1.9													
			Reinforcing Steel	1.9													
			Reinforcing Steel	1.9													
			Reinforcing Steel	1.9													
			Bar Lists	1.9													

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CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF ACTION
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02755	Bar Lists	1.9													
			Bar Lists	1.9													
			Bar Lists	1.9													
			Erection/Installation Drawings	1.9													
			Expansion and Construction Joint Details	1.9													
			SD-05 Design Data														
			Concrete Mix Design	2.6													
			SD-06 Test Reports														
			Concrete Slump	3.1.1													
			Air Content	3.1.1													
			Test Specimens	3.1.1													
			Beam														
			Drilled Cores														
			Daily Activity Report	3.1.1													
			Location of Placement	3.1.1													
			Quantity in Cubic Yards of Placement	3.1.1													
			Quantity in Square Yards of Placement	3.1.1													
			Start Time of Pourer Placement	3.1.1													
			SD-07 Certificates														
			Wire Mesh	2.1.2													
			Fabricated Bar Mats	2.1.3													
			Reinforcing Bars	2.1.4													
			Joint Dowel Bars	2.1.5													

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Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
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(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02755	Hook Bolts	2.1.7													
			Load-Transfer Devices	2.1.9													
			Metal Joint Inserts	2.1.10													
			Joint Materials	2.2													
			Curing Materials	2.3													
			Form Materials	2.4													
			Concrete Materials	2.5													
			Concrete Mix Design	2.6													
			SD-08 Manufacturer's Instructions														
			Cold-Weather Curing	3.11.2													
			Hot-Weather Curing	3.11.3													
			Curing Methods	3.11.4													
			Sawing Concrete Joints	3.9.7													
			Joint Sealant	3.12.2													
			SD-11 Closeout Submittals														
			Ending Time of Placement	3.1.1													
			Delivery Tickets	3.1.1													
			Delivery Tickets	3.5													
		02773	SD-05 Design Data														
			Mix design data	2.6													
			SD-06 Test Reports														
			Slump	1.4													
			Compression Test	1.4													
			Concrete Temperature	1.4													
			Air Content	1.4													
			Yield	1.4													

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Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF ACTION	DATE RCD FROM CONTR	DATE FWD TO APPR AUTH/ DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF ACTION
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02773	Air Dried Unit Weight	1.4													
			Unit Weight of Fresh Concrete	1.4													
			SD-07 Certificates														
			Reinforcing Steel	2.1													
			Form Materials	2.2													
			Curing Materials	2.3													
			Joint Materials	2.4													
			Concrete Materials	2.5													
			Concrete-Mix Design	2.6													
			SD-08 Manufacturer's Instructions														
			Concrete Curbs and Gutters	3.4.2													
		02811	SD-02 Shop Drawings														
			As-Built Drawings	1.6													
			SD-03 Product Data														
			Piping	2.1													
			Gate Valves	2.3													
			Quick-Coupling Valves	2.4													
			Check Valves	2.5													
			Automatic Controllers, Electrical	2.6													
			Remote Control Valves, Electrical	2.7													
			Electrical Power, Supply Voltage	2.8													
			Sprinkler Heads	2.10													
			Sprinkler Heads	3.10													
			Spare Parts Data	1.9													
			SD-06 Test Reports														
			Hydrostatic Test	3.12													

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Corrosion Control/AGE, Malmstrom AFB

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A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
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		02811	SD-07 Certificates														
			Piping	2.1													
			Gate Valves	2.3													
			Quick-Coupling Valves	2.4													
			Check Valves	2.5													
			Automatic Controllers, Electrical	2.6													
			Remote Control Valves, Electrical	2.7													
			Electrical Power, Supply Voltage	2.8													
			Sprinkler Heads	2.10													
			Sprinkler Heads	3.10													
			SD-08 Manufacturer's Instructions														
			Equipment and System	1.7													
			Packages														
			Special Tools	1.8													
			Keys	1.8.1													
			Coupler(s)/Matching Hose	1.8.2													
			Swivels.														
			SD-10 Operation and Maintenance														
			Data														
			Operation and Maintenance	1.7													
			Manuals														
		02825	SD-02 Shop Drawings														
			Erection/Installation Drawings	1.3													
			Fence Assembly	1.3													
			Gate Assembly	1.3													
			Gate Hardware and Accessories	2.16													

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A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
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(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02825	SD-03 Product Data														
			Fence Assembly	1.3													
			Gate Assembly	1.3													
			Gate Hardware and Accessories	2.16													
			SD-04 Samples														
			Fabric	2.3													
			Fabric	2.4													
			Fabric	3.8													
			Supporting Arms														
			Gate Hardware and Accessories	2.16													
			Wire Ties	2.18													
			SD-07 Certificates														
			Zinc Coating	2.2													
			Zinc Coating	2.10													
			Fabric	2.3													
			Fabric	2.4													
			Fabric	3.8													
			Stretcher Bars	2.11													
			Gate Hardware and Accessories	2.16													
			Concrete	2.19													
			Concrete	3.4													
			SD-08 Manufacturer's Instructions														
			Fence Assembly	1.3													
			Gate Assembly	1.3													
			Hardware Assembly	1.3													
			Accessories	1.3													

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Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	BY (i)	A C T I O N C O D E	DATE OF A C T I O N (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E			DATE OF A C T I O N (p)
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02825	Accessories	1.3													
		02870	SD-03 Product Data														
			Bicycle Racks	2.3													
			SD-04 Samples														
			Finish	2.2.2	G												
			SD-06 Test Reports														
			Recycled Materials														
			Testing	3.3													
			SD-07 Certificates														
			Primer certificate														
			Powder coatings certificate	1.4.3													
		02920	SD-09 Manufacturer's Field														
			Reports														
			Grass Seed	2.3													
			Top Soil	2.1													
		02921	SD-03 Product Data														
			Wood cellulose fiber mulch	2.5.3													
			Fertilizer	2.4													
			SD-06 Test Reports														
			Topsoil composition tests	2.2.3													
			SD-07 Certificates														
			seed	2.1													
			SD-08 Manufacturer's Instructions														
			Erosion Control Materials	2.7													
		02935	SD-01 Preconstruction Submittals														
			Written Notice of Plant Deliveries	1.4													

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TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						APPROVAL NEEDED	MATERIAL NEEDED		A C T I O N C O D E	DATE OF A C T I O N	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF A C T I O N
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	SUBMIT (g)	BY (h)	BY (i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02935	SD-03 Product Data														
			Mulch	2.1.3													
			SD-04 Samples														
			Mulch	2.1.3													
			SD-10 Operation and Maintenance Data														
			Installed Trees	3.5													
			Installed Plants	3.5													
			Installed Ground Cover	3.5													
		03300	SD-01 Preconstruction Submittals														
			Construction Equipment Lists														
			Historical Data														
			SD-02 Shop Drawings														
			Fabrication Drawings	1.8													
			Reinforcement Materials	1.8													
			Reinforcement Materials	2.4													
			Wall Forms	1.8													
			Drilled Pier Dobies														
			Formwork	3.1													
			SD-03 Product Data														
			Concrete Aggregates	2.1.1													
			Portland Cement	2.1.2													
			Ready-Mix Concrete	2.2													
			Form Facing Materials	2.3													
			Reinforcement Materials	1.8													
			Reinforcement Materials	2.4													

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Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		03300	Joint Materials	2.5													
			Water-Vapor Barrier Subgrade	2.6													
			Cover														
			Bonding Materials														
			Floor Finish Materials	2.7													
			Concrete Curing Materials	2.8													
			SD-05 Design Data														
			Ready-Mix Concrete	2.2													
			SD-06 Test Reports														
			Chemical Composition	3.11													
			Mechanical Usability	3.11													
			Soundness	3.11													
			Slump	2.9.4													
			Air Entrainment	2.9.1													
			Compressive Strength	3.11													
			SD-07 Certificates														
			Welder Qualifications														
			Concrete Design Mixes	1.6													
			Concrete Aggregates	2.1.1													
			Welding Procedures														
			SD-08 Manufacturer's Instructions														
			Admixtures	2.1.3													
			Bonding Materials														
			Liquid Chemical Floor Hardener	2.7.1													
			SD-11 Closeout Submittals														
			Communication														

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TITLE AND LOCATION Corrosion Control/AGE, Malmstrom AFB						CONTRACTOR											
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		04810	SD-03 Product Data														
			Full-size units														
			SD-04 Samples														
			Colored masonry mortar samples														
			Aluminum weep holes/vents														
			Accessories														
		05095	SD-06 Test Reports														
			Non-Destructive Examination	3.2.4													
			SD-07 Certificates														
			Certified Welding Procedure	1.4.2.2													
			Specifications (WPS)														
			Certified Brazing Procedure	1.4.2.2													
			Specifications (BPS)														
			Certified Procedure Qualification	1.4.2.2													
			Records (PQR)														
			Certified Welder Performance	1.4.2.2													
			Qualifications (WPQ)														
			Certified Brazer Performance	1.4.2.2													
			Qualifications (BPQ)														
		05500	SD-02 Shop Drawings														
			Structural Steel	2.14.1													
			Joints	2.14.1													
			Castings	2.14.1													
			Miscellaneous Metal Items	2.15													
			SD-03 Product Data														

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Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF ACTION	DATE RCD FROM CONTR	DATE FWD TO APPR AUTH/ TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF ACTION
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		05500	Structural Steel Plates, Shapes, and Bars	2.1													
			Structural Steel Tubing	2.2													
			Hot-Rolled Carbon Steel Bars and Bar Size Shapes	2.3													
			Hot-Rolled Carbon Steel Sheets and Strips	2.4													
			Cold-Rolled Carbon Steel Sheets	2.5													
			Galvanized Carbon Steel Sheets	2.6													
			Gray Iron Castings	2.7													
			Malleable Iron Castings	2.8													
			Raised Pattern Steel Floor Plates	2.9													
			Steel Bar Grating	2.10													
			Access Panels and Frames	2.15.1													
			Roof Scuttles	2.15.11													
			Steel Pipe Railing	2.15.14													
			Wheel Guards	2.17													
			Wire Mesh Partitions														
			Wire Mesh Window Guards														
			Anchorage Materials	2.11													
			Paint Materials	2.13													
			Fastening Materials	2.12													
			Miscellaneous Metal Items	2.15													
			SD-04 Samples														
			Cast Abrasive Thresholds	2.15.2													

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TITLE AND LOCATION Corrosion Control/AGE, Malmstrom AFB						CONTRACTOR											
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
	05500		Metal Safety Nosing for Concrete Treads	2.15.9													
			Anchorage Materials	2.11													
			Fastening Materials	2.12													
			Lock Cylinder														
			SD-07 Certificates														
			Welding Procedures	1.5													
			Welder Qualifications	1.5													
			Miscellaneous Metal Items	2.15													
			SD-08 Manufacturer's Instructions														
			Miscellaneous Metal Items	2.15													
	06100		SD-06 Test Reports														
			Moisture Content	2.1.1													
			Fire-Retardant-Treated Lumber														
			SD-07 Certificates														
			Framing Materials														
			Anchorage and Fastener Materials	2.2													
			Preservative Treated Lumber	2.1.3													
	06200		SD-02 Shop Drawings														
			Fabrication Drawings	1.6													
			Hardwood Plywood Paneling														
			Counters, Cabinets, and Casework	3.2.2													
			Wood Trim	1.7													
			Wood Trim	2.1.3.2													

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TITLE AND LOCATION Corrosion Control/AGE, Malmstrom AFB						CONTRACTOR											
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/		
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF A C T I O N		DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			A C T I O N C O D E
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	REMARKS (r)
		06200	Wood Trim	3.2.1													
			Plastic Laminate Counter Tops.	3.2.3													
			Edges and Backsplashes														
			Shelving	2.1.1.1													
			Shelving	3.2.4													
			SD-04 Samples														
			Hardwood Plywood	1.7													
			Pre-Finished Plywood	1.7													
			Solid Wood Paneling	1.7													
			Wood Trim	1.7													
			Wood Trim	2.1.3.2													
			Wood Trim	3.2.1													
			Plastic Laminate	1.7													
			Plastic Laminate	2.2.3													
			Plastic Laminate	2.2.3.2													
			Manufacturer's Standard Color	1.7													
			Charts														
			SD-07 Certificates														
			Plywood Paneling	2.1.1													
			Plywood Paneling	2.3.1.1													
			Fasteners and Adhesives	2.1.2													
			Solid Wood	2.1.3													
			Counters, Cabinets, and	3.2.2													
			Casework														
			Cabinet Hardware	2.2.2													
			Plastic Laminate	1.7													

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Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF A C T I O N	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF A C T I O N
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		06200	Plastic Laminate	2.2.3													
			Plastic Laminate	2.2.3.2													
			Priming and Sealing	2.3.1													
		07210	SD-03 Product Data														
			Glass Fiber Insulation Board	2.1.1													
			Batts and Rolls	2.1.1.1													
			Mineral-Fiber Batts	2.1.2													
			Mineral-Fiber Flexible Blankets	2.1.3													
			Blown-In Mineral-Fiber Insulation														
			Rigid Polystyrene Board	2.1.4													
			Rigid Polyurethane Board	2.1.5													
			Vapor Barrier	2.1.6													
			Vapor Barrier Tape	2.1.7													
			Water-Vapor Barrier Subgrade	2.1.8													
			Covers														
			Fasteners	2.2.1													
			Adhesive	2.2.2													
			Nails	2.2.3													
			Staples	2.2.4													
			Wire Netting	2.2.5													
			Vapor-Barrier Adhesive	2.2.6													
			SD-04 Samples														
			Glass-Fiber Insulation Board	2.1.1													
			Mineral Fiber Batts	2.1.2													
			Mineral-Fiber Flexible Blankets	2.1.3													
			Vapor-Barrier	2.1.6													

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Corrosion Control/AGE, Malmstrom AFB																	
ACTIVITY NO	TRANSMITTAL NO	SPEC NO	DESCRIPTION	PARAGRAPH	CLASSIFICATION G O V T C L A S S I F I C A T I O N S I F I C A R T I V E O W N E R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT	BY	BY	ACTION	DATE OF ACTION		DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			DATE OF ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		07210	Blown-In Mineral-Fiber Insulation														
			Vapor Barrier Tape	2.1.7													
			Water-Vapor Barrier Subgrade	2.1.8													
			Covers														
			Rigid Polystyrene Board	2.1.4													
			Rigid Polyurethane Board	2.1.5													
			Fasteners	2.2.1													
			Adhesive	2.2.2													
			Wire Netting	2.2.5													
			SD-06 Test Reports														
			Test Reports	3.8													
			SD-07 Certificates														
			Glass Fiber Insulation Board	2.1.1													
			Batts and Rolls	2.1.1.1													
			Mineral-Fiber Batts	2.1.2													
			Mineral-Fiber Flexible Blankets	2.1.3													
			Blown-In Mineral-Fiber Insulation														
			Rigid Polystyrene Board	2.1.4													
			Rigid Polyurethane Board	2.1.5													
			Vapor Barrier	2.1.6													
			Vapor Barrier Tape	2.1.7													
			Water-Vapor Barrier Subgrade	2.1.8													
			Covers														
			Staples	2.2.4													
			Wire Netting	2.2.5													

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TITLE AND LOCATION Corrosion Control/AGE, Malmstrom AFB						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC NO	DESCRIPTION	PARAGRAPH	CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	ACTION CODE (j)	DATE OF ACTION (k)		DATE RCD FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)			ACTION CODE (o)
	07210		Fire-Retardant Treated Wood														
			Furring Strips														
			SD-08 Manufacturer's Instructions														
			Fasteners	2.2.1													
			Pneumatic Blowing Machine														
			Vapor-Barrier Adhesive	2.2.6													
			SD-11 Closeout Submittals														
			Warranty	3.7.1													
	07220		SD-02 Shop Drawings														
			Wood nailers														
			SD-03 Product Data														
			Fasteners	2.4.2	G												
			Insulation		G												
			SD-06 Test Reports														
			Flame spread and smoke	1.4.1													
			developed ratings														
			SD-07 Certificates														
			qualifications	1.3													
			SD-08 Manufacturer's Instructions														
			fasteners	2.4.2													
			insulation														
	07240		SD-02 Shop Drawings														
			Shop drawings	3.3	G												
			SD-03 Product Data														
			Sheathing board														
			Thermal insulation	2.4													

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Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF A C T I O N	DATE RCD FROM CONTR	DATE FWD TO APPR AUTH/ REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF A C T I O N
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		07240	Adhesive	2.2													
			Mechanical Fasteners	2.3													
			Accessories	2.10													
			Base coat	2.5													
			Portland cement	2.6													
			Reinforcing fabric	2.7													
			Finish coat	2.8													
			Joint Sealant	2.11													
			Primer	2.9													
			Bond breaker	2.12													
			Backer Rod	2.13													
			Insulation Board	1.4.5													
			Warranty	1.7													
			SD-04 Samples														
			Sample Boards	1.2.3.7	G												
			Mock-up Installation of EIFS	1.2.1.4	G												
			SD-05 Design Data														
			Wind load	1.2.1.2													
			Moisture analysis	1.2.4													
			SD-06 Test Reports														
			Abrasion resistance	1.2.3.1													
			Accelerated weathering	1.2.3.2													
			Impact resistance	1.2.2.3													
			Mildew resistance	1.2.3.3													
			Salt spray resistance	1.2.3.4													
			vapor transmission	1.2.4													

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Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		07240	Absorption-freeze-thaw	1.2.3.6													
			Wall fire test	1.2.1.3													
			Water penetration	1.2.1.1													
			Water resistance	1.2.3.5													
			Full scale or intermediate scale fire test	1.2.1.3													
			Surface Burning Characteristics	1.2.2.1													
			Radiant heat	1.2.2.2													
			substrate	3.1													
			Wind load	1.2.1.2													
			SD-07 Certificates														
			Qualifications of EIFS	1.4.1													
			Manufacturer														
			Qualification of EIFS Installer	1.4.2													
			Qualification of Sealant Applicator	1.4.3													
			Qualifications of Third Party	1.4.4													
			Inspector														
			Inspection Check List	3.5.2	G												
			SD-08 Manufacturer's Instructions														
			Installation	3.3													
			SD-10 Operation and Maintenance														
			Data														
			EIFS	1.7													
		07600	SD-02 Shop Drawings														
			Minimum Dimensions and	2.1.3													
			Thicknesses														

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Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N / E A R T H Q U A K E R E V I S I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						DATE SUBMIT (g)	APPROVAL NEEDED BY (h)	MATERIAL NEEDED BY (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
		07600	Miscellaneous Components														
			Flashing	3.2													
			Sheet Metal	2.1													
			SD-07 Certificates														
			Fasteners	2.4													
			Solder Materials	2.3													
			Cement														
			Sealing Compound	2.2.1													
			Aluminum	2.1.1													
			Galvanized Steel	2.1.2													
		07840	SD-02 Shop Drawings														
			Firestopping Materials														
			SD-07 Certificates														
			Firestopping Materials														
			Installer Qualifications														
			Inspection														
		08100	SD-02 Shop Drawings														
			Steel Doors	2.1.1													
			Frames	2.1.2													
			Steel Doors	2.1.1													
			Frames	2.1.2													
			SD-03 Product Data														
			Steel Doors	2.1.1													
			Frames	2.1.2													
			Finish Hardware	2.2													
			Reinforcement	2.2													

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CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N / R E V I E W E R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		08100	SD-07 Certificates														
			Steel Doors	2.1.1													
			Frames	2.1.2													
			Finish Hardware	2.2													
			Reinforcement	2.2													
		08120	SD-02 Shop Drawings														
			Finish Hardware	2.4													
			Aluminum Doors	2.5.4													
			Frames	2.5.5													
			Finish Hardware	2.4													
			Aluminum Doors	2.5.4													
			Frames	2.5.5													
			SD-03 Product Data														
			Aluminum Doors	2.5.4													
			Paint Materials	2.2													
			Glazing Materials	2.3													
			Finish Hardware	2.4													
			Installation Materials	2.6													
			Thresholds	2.4.9													
			Frames	2.5.5													
			Weatherstripping	2.5.8													
			SD-04 Samples														
			Aluminum Finish	2.5.6													
			Preformed Glazing Gaskets	2.3													
			Anchorage Devices	2.6.4													
			Anchorage Devices	3.1.3													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF A C T I O N	DATE RCD FROM CONTR	DATE FWD TO APPR AUTH/ TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF A C T I O N
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		08120	Anchorage Devices	3.1.4													
			Fasteners	2.6.6													
			Lock Cylinders	2.4.6													
			SD-05 Design Data														
			Aluminum Doors	2.5.4													
			Frames	2.5.5													
			Aluminum Alloy	1.3.1													
			Structural Steel	1.3.1													
			Sheet and Strip	1.3.1													
			SD-06 Test Reports														
			Finishes, Except Hardware	2.5.6													
			SD-07 Certificates														
			Metals for Fabrication	2.1													
			Paint Materials	2.2													
			Glazing Materials	2.3													
			Finish Hardware	2.4													
			Installation Materials	2.6													
			SD-08 Manufacturer's Instructions														
			Preventive Maintenance and	2.5.6													
			Inspection														
			Finishes, Except Hardware	2.5.6													
			Cleaning Materials	2.5.6													
			Application Methods	2.5.6													
			SD-10 Operation and Maintenance														
			Data														
			Finish Hardware	2.4													

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CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT	BY	MATERIAL NEEDED	A C T I O N C O D E	DATE OF A C T I O N	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF A C T I O N
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		08120	Aluminum Doors	2.5.4													
			Frames	2.5.5													
		08210	SD-02 Shop Drawings														
			Solid Core Doors	2.1.3													
			Fire-Rated Labeled Doors	2.1.4													
			Solid Core Doors	2.1.3													
			Fire-Rated Labeled Doors	2.1.4													
			Facing	2.2													
			Cutout Openings														
			Finish Hardware	3.1													
			SD-03 Product Data														
			Solid Core Doors	2.1.3													
			Fire Rated Labeled Doors	2.1.4													
			Facing	2.2													
			Cutout Openings														
			Door Louvers														
			SD-07 Certificates														
			Solid Core Doors	2.1.3													
			Fire Rated Labeled Doors	2.1.4													
			Facing	2.2													
		08800	SD-04 Samples														
			Clear Glass	2.1.1													
			Heat Absorbing Glass	2.1.2													
			Safety Rated Tempered Glass	2.1.3													
			Clear Sheet Glass	2.1.4													
			Double Glazing Units	2.1.6													

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TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT	BY	MATERIAL NEEDED	A C T I O N C O D E	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF ACTION
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		08800	Elastic Glazing Compound	2.3.1													
			Elastomeric Sealing Compound	2.3.4													
			SD-07 Certificates														
			Glass Materials	2.1													
			Glazing Materials	2.3													
			Safety Rated Tempered Glass	2.1.3													
			Fire-Rated Wired Glass	2.1.5													
		08950	SD-06 Test Reports														
			Flame Spread and Smoke														
			Developed														
			Burn Extent														
			Color Difference														
			Impact Strength														
			Tensile Bond Strength														
			Shear Bond Strength														
			Beam Bending Strength														
			Insulation 'U' Factor														
			NFRC Certification - Optional														
			Condensation Resistance Factor														
			Class A Roof Covering Burning														
			Brand														
			Class A Roof System UL Listed														
			Class I Fire Approval														
			Quality Control Monitoring														
			Energy and Structural														
			Calculations														

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CONTRACT NO.

TITLE AND LOCATION Corrosion Control/AGE, Malmstrom AFB						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC NO	DESCRIPTION	PARAGRAPH	GLASS / FIVE VIEW OR N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						APPROVAL NEEDED	MATERIAL NEEDED		ACTION CODE	DATE OF ACTION		DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			ACTION CODE
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	SUBMIT (g)	BY (h)	BY (i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		09250	SD-02 Shop Drawings														
			Hangers and Inserts	2.2.8.1													
			Channels	2.2.8.2													
			Resilient Channels	2.2.8.3													
			Steel Stud Framing	2.2.8.4													
			Metal Accessories	2.2.9													
			Trim	2.2.9													
			Suspension	2.2.8.2													
			Furring	2.2.8.2													
			SD-03 Product Data														
			Gypsum Wallboard	2.2.3													
			Furring	2.2.8.2													
			Hangers and Inserts	2.2.8.1													
			Suspension	2.2.8.2													
			Channels	2.2.8.2													
			Resilient Channels	2.2.8.3													
			Joint Tapes	2.2.6.1													
			Compounds	2.2.6.2													
			Steel-Stud Framing	2.2.8.4													
			Metal-Framed Drywall Ceilings	3.2.19.1													
			Fasteners	2.2.7													
			Adhesives	2.2.6.2													
			Floor and Ceiling Runners	2.2.8.4													
			Special Framed Openings	1.3													
			Rated Wallboard Assemblies	1.3													
			SD-04 Samples														

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TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N / E A R T H Q U A K E R E S I S T A N C E	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF A C T I O N (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF A C T I O N (p)
		09250	Gypsum Wallboard	2.2.3													
			Steel-Stud Framing	2.2.8.4													
			Fasteners	2.2.7													
			Trim	2.2.9													
			SD-07 Certificates														
			Certificates	1.3													
		09310	SD-03 Product Data														
			Wall Tile	2.2.1.1													
			Ceramic Tile Trim	2.3.1													
			Ceramic Floor Tile	2.2.1.2													
			Mortar	2.4.2													
			Mortar	2.4.3													
			Mortar	2.4.4													
			Grout Materials	2.1.1													
			Membrane Materials	2.1.2													
			Metal Reinforcement Materials	2.1.3													
			SD-04 Samples														
			Manufacturer's Standard Color	2.1													
			Charts														
			Wall Tile	2.2.1.1													
			Ceramic Floor Tile	2.2.1.2													
			Ceramic Tile Trim	2.3.1													
			SD-07 Certificates														
			Wall Tile	2.2.1.1													
			Ceramic Tile Trim	2.3.1													
			Ceramic Floor Tile	2.2.1.2													

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TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF ACTION	DATE RCD FROM CONTR	DATE FWD TO APPR AUTH/ TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF ACTION
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		09310	Mortar	2.4.2													
			Mortar	2.4.3													
			Mortar	2.4.4													
			Grout Materials	2.1.1													
			Membrane Materials	2.1.2													
			Metal Reinforcement Materials	2.1.3													
		09510	SD-02 Shop Drawings														
			Installation Drawings	1.4													
			Acoustical Ceilings	1.4													
			SD-03 Product Data														
			Acoustic Materials	2.1													
			Suspension System Materials	2.2													
			SD-04 Samples														
			Acoustic Units	1.4													
			Suspension System Members	1.4													
			Anchorage Devices	1.4													
			Fasteners	1.4													
			SD-08 Manufacturer's Instructions														
			Acoustic Materials	2.1													
			Suspension Systems	3.1													
		09650	SD-03 Product Data														
			Vinyl Composition Tile	2.1.2													
			Base	2.1.3													
			Vinyl Reducer Strips	2.1.4													
			Vinyl Feature Strips	2.1.5													
			Substrate Primer/Sealer	2.1.6													

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Corrosion Control/AGE, Malmstrom AFB

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CONTRACTOR

A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF ACTION
		09650	Adhesive	2.1.7													
			Edge Strips	2.1.8													
			SD-04 Samples														
			Manufacturer's Standard Color	1.5													
			Charts														
			SD-08 Manufacturer's Instructions														
			Manufacturer's Instructions	1.5													
			Preventive Maintenance and	1.5													
			Inspection														
		09680	SD-02 Shop Drawings														
			Carpet	2.2													
			Carpet Moldings	2.3													
			SD-03 Product Data														
			Carpet	2.2													
			Carpet Moldings	2.3													
			SD-04 Samples														
			Carpet	2.2													
			Seam Tape	3.1													
			Edge Molding	3.1													
			Accessories	3.1													
			SD-07 Certificates														
			Carpet	2.2													
			Carpet Moldings	2.3													
			SD-08 Manufacturer's Instructions														
			Installation	3.1													
		09725	SD-02 Shop Drawings														

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Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		09725	Fabrication Drawings	1.5													
			Vinyl Wall Covering	2.1													
			SD-03 Product Data														
			Vinyl Wall Covering	2.1													
			Adhesive, Primer, and Sealer	2.2													
			SD-04 Samples														
			Wall Covering	2.1													
			SD-07 Certificates														
			Vinyl Wall Covering	2.1													
			SD-08 Manufacturer's Instructions														
			Wall Covering	2.1													
			Vinyl Wall Covering	2.1													
			SD-09 Manufacturer's Field														
			Reports														
			Records	1.5													
		09920	SD-03 Product Data														
			Inhibitive Metal Primer														
			Pigmented Sealer														
			Latex Block Filler														
			Alkali Resistant Primer														
			Enamel Undercoat														
			Exterior Wood Primer														
			Acrylic Latex														
			Acrylic Epoxy														
			SD-04 Samples														

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CONTRACT NO.

TITLE AND LOCATION Corrosion Control/AGE, Malmstrom AFB						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC NO	DESCRIPTION	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT (g)	BY (h)	BY (i)	ACTION (j)	DATE OF ACTION (k)		DATE RCD FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)			ACTION (o)
		09920	Manufacturer's Standard Color Charts	2.1													
			SD-07 Certificates														
			Safety Plan	3.1													
		09960	SD-01 Preconstruction Submittals														
			Material, Equipment and Fixture List	1.4													
			SD-03 Product Data														
			Heat-Resistant Coatings	2.1													
			Epoxy Coatings	2.2													
			Polyurethane Coatings	2.3													
			Chlorinated-Rubber Coatings	2.4													
			SD-04 Samples														
			Color Chips	1.4													
			SD-07 Certificates														
			Heat-Resistant Coatings	2.1													
			Epoxy Coatings	2.2													
			Polyurethane Coatings	2.3													
			Chlorinated-Rubber Coatings	2.4													
		10160	SD-02 Shop Drawings														
			Fabrication Drawings	1.6													
			Installation Drawings	3.1													
			SD-03 Product Data														
			Galvanized Steel Sheet	2.1													
			Sound Deadening Cores	2.2													
			Partition Panels and Doors	2.3													

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Corrosion Control/AGE, Malmstrom AFB

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A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T		P A R A G # R A P H	C L A S S I F I C A T I O N O W N R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY							
									A C T I O N C O D E			DATE FWD TO APPR AUTH/			A C T I O N C O D E			DATE OF ACTION	DATE RCD FRM APPR
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	SUBMIT (g)	APPROVAL NEEDED BY (h)	MATERIAL NEEDED BY (i)	(j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)	(o)	DATE OF ACTION (p)	DATE RCD FRM APPR AUTH (q)	REMARKS (r)		
		10160	Anchoring Devices and Fasteners	2.7															
			Hardware and Fittings	2.8															
			Brackets	2.9															
			Door Hardware	2.10															
			Ceiling-Hung Partitions																
			Floor-Supported Partitions	2.11															
			Overhead-Braced Partitions	2.12															
			SD-04 Samples																
			Partition Panels	2.3															
			Partition Panels	2.4															
			Hardware and Fittings	2.8															
			Anchoring Devices and Fasteners	2.7															
			SD-07 Certificates																
			Certification	1.7															
		10500	SD-02 Shop Drawings																
			Fabrication Drawings	1.8															
			Installation Drawings	1.8															
			SD-03 Product Data																
			Locker Materials	2.1															
			Hardware and Accessories	2.2															
			SD-04 Samples																
			Color Chips	1.8															
			SD-07 Certificates																
			Certificates	1.8															
		10520	SD-03 Product Data																
			Fire Extinguishers	2.1															

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Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						DATE SUBMIT (g)	APPROVAL NEEDED BY (h)	MATERIAL NEEDED BY (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
		10520	Fire Protection Cabinets	2.2													
			Fire Protection Cabinets	2.3.1													
			door hardware	2.2.1													
			cabinet type	2.2.1													
			trim style	2.2.1													
		10800	SD-03 Product Data														
			Mirror Glass	2.3													
			Mounting Devices and Fasteners	2.4													
			Paper Towel Dispensers	2.5.1													
			Waste Receptacle	2.5.2													
			Feminine Napkin Dispenser														
			Feminine Napkin Disposal														
			Toilet Tissue Dispenser	2.5.3													
			Liquid-Soap Dispenser	2.5.4													
			Shelf	2.5.5													
			Framed Mirrors	2.5.6													
			Medicine Cabinets														
			Grab Bars	2.5.7													
			Towel Bar	2.5.8													
			Shower-Curtain Rod	2.5.9													
			Robe Hook	2.5.10													
			SD-04 Samples														
			Samples	2.5													
		12485	SD-04 Samples														
			Entrance Mats														
		12495	SD-02 Shop Drawings														

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CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N / R E V I E W E R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF A C T I O N	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF A C T I O N
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		12495	Venetian Blinds	2.1													
			Venetian Blinds	3.2													
			SD-04 Samples														
			Venetian Blinds	2.1													
			Venetian Blinds	2.1													
			Venetian Blinds	3.2													
			Venetian Blinds	3.2													
			SD-07 Certificates														
			Venetian Blinds	2.1													
			Venetian Blinds	3.2													
		13110	SD-01 Preconstruction Submittals														
			Qualified Corrosion Engineer	1.3.1													
			SD-02 Shop Drawings														
			Installation Drawings	3.8													
			SD-03 Product Data														
			Anodes	2.1													
			Conduit	2.4													
			Test Boxes and Junction Boxes	2.5													
			Coatings	2.6													
			Preformed Sheaths	2.7													
			Epoxy Potting Compound	2.8													
			Insulating Pipe Sleeves	2.11													
			Electrically Insulating Pipe Joints	2.12													
			Electrically Conductive Couplings	2.13													
			Casing Centering Cradles and	2.14													
			Casing Seals														

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CONTRACT NO.

TITLE AND LOCATION Corrosion Control/AGE, Malmstrom AFB						CONTRACTOR											
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF A C T I O N		DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			A C T I O N C O D E
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		13110	SD-06 Test Reports														
			Static Potential-to-Soil	3.3.1													
			Insulation Tests	3.3.2													
			Output Measurements	3.3.3													
			Electrode Potential	3.3.1													
			Measurements														
			Casing Tests	3.3.6													
			Interference Tests	3.3.7													
		13852	SD-01 Preconstruction Submittals														
			Material, Equipment, and Fixture	2.1													
			Lists														
			SD-02 Shop Drawings														
			Schematics	2.2													
			SD-03 Product Data														
			Fire Alarm Systems	2.1													
			Alarm Control Units	2.2													
			Heat-Actuated Detectors	2.3													
			Product-Of-Combustion	2.4													
			Detectors														
			Manual Alarm Stations	2.5													
			Audio Alarms														
			Wiring and Raceway	2.7													
			Revolving Beacon	2.9													
			Strobe Lights														
			Transceiver, antennae and all														
			associated devices														

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TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/		
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF A C T I O N		DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			A C T I O N C O D E
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		13852	Software for New System	3.2													
			SD-05 Design Data														
			Listing of Product Installations	3.2													
			SD-06 Test Reports														
			Preliminary Tests	3.3.1													
			Preliminary Tests	3.3.2													
			Preliminary Tests	3.3.4.1													
			Acceptance Test	3.3.1													
			Acceptance Test	3.3.3													
			Ground Detection Test	3.3.4.1													
			Standby Power Test	3.3.4.1													
			Trouble Test	3.3.4.1													
			SD-07 Certificates														
			Fire Alarm Systems	2.1													
			Alarm Control Units	2.2													
			Heat-Actuated Detectors	2.3													
			Product-Of-Combustion	2.4													
			Detectors														
			Manual Alarm Stations	2.5													
			Audio Alarms														
			Wiring and Raceway	2.7													
			Revolving Beacon	2.9													
			Strobe Lights														
			Transceiver, antennae and all														
			associated devices														

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CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF ACTION
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	SUBMIT (g)	BY (h)	BY (i)	(j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)	(o)	DATE OF ACTION (p)	DATE RCD FRM APPR (q)	(r)
		13852	Fire Alarm Contractor	1.5													
			Qualifications														
		13935	SD-02 Shop Drawings														
			Shop Drawings	1.12	G												
			As-Built Drawings	3.11													
			SD-03 Product Data														
			Sway Bracing	3.4.1	G												
			Materials and Equipment	2.3	G												
			Hydraulic Calculations	1.7	G												
			Spare Parts	1.11													
			Preliminary Tests	3.10	G												
			Final Acceptance Test	3.11	G												
			On-site Training	3.12	G												
			Fire Protection Specialist	1.8	G												
			Sprinkler System Installer	1.9	G												
			SD-06 Test Reports														
			Preliminary Test Report	3.11	G												
			Final Acceptance Test Report	3.11	G												
			SD-07 Certificates														
			Inspection by Fire Protection	3.3	G												
			Specialist														
			SD-10 Operation and Maintenance														
			Data														
			Operating and Maintenance	3.12													
			Instructions														
		13965	SD-02 Shop Drawings														

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A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	BY (i)	A C T I O N C O D E	DATE OF A C T I O N (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E			DATE OF A C T I O N (p)
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		13965	Dry Chemical Fire Extinguishing System		G												
			SD-03 Product Data														
			Similar Services	1.3.5													
			Dry Chemical Fire Extinguishing System		G												
			Preliminary Tests	3.2	G												
			Final Acceptance Tests	3.3	G												
			Field Training	3.4													
			SD-06 Test Reports														
			Preliminary Tests	3.2													
			Final Acceptance Tests	3.3													
			SD-07 Certificates														
			Installation Technician	1.3.4	G												
			Installation Drawings	1.3.3	G												
			SD-10 Operation and Maintenance Data														
			Dry Chemical Fire Extinguishing System														
		15050	SD-01 Preconstruction Submittals														
			Material, Equipment, and Fixture Lists	1.2													
			SD-02 Shop Drawings														
			As-Built Drawings	1.2													
			Connection Diagrams	1.2													
			Coordination Drawings	1.2													

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TITLE AND LOCATION Corrosion Control/AGE, Malmstrom AFB						CONTRACTOR											
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF A C T I O N		DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			A C T I O N C O D E
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		15050	Fabrication Drawings	1.2													
			Installation Drawings	3.1													
			SD-03 Product Data														
			Pipe and Fittings	2.1													
			Piping Specialties	2.2													
			Valves	2.3													
			Miscellaneous Materials	2.4													
			Supporting Elements	2.5													
			Glycol														
			Equipment Foundation Data	1.2													
			SD-04 Samples														
			Manufacturer's Standard Color	1.2													
			Charts														
			SD-06 Test Reports														
			Hydrostatic Tests	3.1													
			Air Tests	3.1													
			Valve-Operating Tests	3.1													
			Drainage Tests	3.1													
			Pneumatic Tests	3.1													
			Non-Destructive Electric Tests	3.1													
			System Operation Tests	3.1													
			SD-10 Operation and Maintenance														
			Data														
			Operation and Maintenance	3.10													
			Manuals														
		15055	SD-04 Samples														

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ACTIVITY NO	TRANSMITTAL NO	SPEC	DESCRIPTION	PARAGRAPH	GOVT CLASS / FICARVIEW OR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS			
						SUBMIT	BY	BY	ACTION	DATE OF ACTION		DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			ACTION	DATE OF ACTION	DATE RCD FRM APPR AUTH
		15055	Welder's Pre-Qualification Samples	1.3.1															
			SD-06 Test Reports Radiographs	3.3.1															
			SD-07 Certificates Certified Welding Procedure Specifications	1.3															
			Certified Brazing Procedure Specifications	1.3															
			Certified Procedure Qualification Records	1.3															
			Certified Welder Performance Qualifications																
			Certified Brazer Performance Qualifications																
		15083	SD-03 Product Data Adhesives	2.1.1															
			Coatings	2.1.2															
			Thermal-Insulation Materials	2.1.3															
			Jacketing Materials	2.1.4															
			Duct liner-																
		15085	SD-02 Shop Drawings Installation Drawings	3.1															
			SD-03 Product Data Adhesives	2.1.1															
			Coatings	2.1.2															

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Corrosion Control/AGE, Malmstrom AFB

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT		PARAGRAPH	CLASSIFICATION OWNER	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH		
									ACTION CODE			DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR			ACTION CODE			
(a)	(b)	(c)	DESCRIPTION (d)	(e)	(f)	SUBMIT (g)	APPROVAL NEEDED (h)	MATERIAL NEEDED (i)	(j)	DATE OF ACTION (k)	(l)	(m)	(n)	(o)	(p)	(q)	REMARKS (r)	
		15085	Insulating Cement	2.1.3														
			Insulation Materials	2.1.6														
			Jacketing	2.1.7														
			Tape	2.1.8														
		15102	SD-01 Preconstruction Submittals															
			Material, Equipment, and Fixture Lists	1.4														
			SD-02 Shop Drawings															
			Detail Drawings	1.4														
			Installation Drawings	3.1														
			SD-03 Product Data															
			Equipment and Performance Data															
			SD-06 Test Reports															
			Test Reports	3.7														
		15107	SD-03 Product Data															
			Manufacturer's Catalog Data	1.4														
			SD-07 Certificates															
			Potable Water Systems Materials															
		15110	SD-02 Shop Drawings															
			Fabrication Drawings	1.3														
			Valves	1.3														
			Accessories	1.3														
			SD-07 Certificates															
			Listing of Product Installation	1.3														
			Globe and Angle Valves	2.2.1														

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Corrosion Control/AGE, Malmstrom AFB

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CONTRACTOR

A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS			
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF A C T I O N		DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			A C T I O N C O D E	DATE OF A C T I O N	DATE RCD FRM APPR AUTH
		15110	Check Valves	2.2.2															
			Ball Valves	2.2.3															
		15119	SD-02 Shop Drawings																
			Fabrication Drawings	1.3															
			Installation Drawings	3.1															
		15120	SD-03 Product Data																
			Backflow Prevention Devices	2.1															
			Water-Hammer Arresters	2.2															
			Wall Hydrants	2.3															
			Water Meters	2.4															
			Pressure Washers																
			Water Treatment Systems																
			Temperature Mixing Valve																
			SD-07 Certificates																
			Backflow Prevention Devices	2.1															
			Water-Hammer Arresters	2.2															
			Wall Hydrants	2.3															
			Water Meters	2.4															
		15135	SD-03 Product Data																
			Equipment and Performance	1.4															
			Data																
		15184	SD-01 Preconstruction Submittals																
			Valves	2.1.7															
			Packing	2.1.7.1															
			Gaskets	2.1.4															
			SD-03 Product Data																

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Corrosion Control/AGE, Malmstrom AFB																	
ACTIVITY NO	TRANSMITTAL NO	SPEC	DESCRIPTION	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/	REMARKS	
						APPROVAL NEEDED	MATERIAL NEEDED		ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE FWD TO OTHER REVIEWER	DATE RCD FROM CONTR	DATE RCD FROM OTH REVIEWER			ACTION CODE
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	SUBMIT (g)	BY (h)	BY (i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		15184	Valves	2.1.7													
			Strainers	2.1.8													
			Pipe	2.1.2													
			Pipe fittings	2.1.3													
			Heat exchanger	2.1.14.1													
			SD-07 Certificates														
			Welding procedure specifications	1.3.6.1													
			Performance qualification record	1.3.6.1													
			Previous qualifications	1.3.6.1													
			Valves	2.1.7													
			Gaskets	2.1.4													
		15185	SD-02 Shop Drawings														
			As-Built Drawings	1.2													
			SD-03 Product Data														
			Air-cooled Condensing Units														
			Refrigerant	2.2													
			Piping	2.5													
			Filter/Dryers	2.6													
			Liquid Sight Glasses	2.7													
			Moisture Indicators	2.8													
			SD-06 Test Reports														
			Testing	3.2													
			SD-10 Operation and Maintenance														
			Data														
			Operation and Maintenance	1.4													
			Manuals														

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ACTIVITY NO	TRANSMITTAL NO	SPEC	DESCRIPTION	PARAGRAPH	CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/	REMARKS		
						SUBMIT	BY	MATERIAL NEEDED	ACTION	DATE OF ACTION	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION			DATE OF ACTION	DATE RCD FRM APPR
	15195		SD-03 Product Data															
			Piping Materials	2.1														
			Valves															
			Piping Specialties	2.2														
			Gas Meters															
			SD-06 Test Reports															
			Leakage	3.2.1														
			Pressure	3.2.3														
	15211		SD-03 Product Data															
			Equipment and Performance Data	1.4														
			Aboveground Piping Materials	2.1														
			Piping Specialties	2.2														
			Supporting Elements	2.6														
			Air Compressors	2.3														
			Valves	2.4														
			Accessories	2.2.3														
			Accessories	3.1.1														
			Accessories	3.1.2														
			Miscellaneous Materials	2.5														
			Vibration Isolation	3.1.4														
			SD-06 Test Reports															
			Hydrostatic Testing	3.2.1														
			Hydrostatic Testing	3.2.1														
			compressed Air Systems Testing	3.2														
			Valve-Operating Tests	3.2.1														

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A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
	15211		Drainage Tests	3.2.1													
			SD-10 Operation and Maintenance Data														
			Operation and Maintenance Manuals														
	15410		SD-01 Preconstruction Submittals														
			Records of Existing Conditions	1.3													
			SD-03 Product Data														
			Plumbing Fixtures and Trim	2.2													
			Sanitary Drain, Waste, and Vent Fixtures	2.3													
			SD-04 Samples														
			Manufacturer's Standard Color Charts	2.1													
			SD-07 Certificates														
			Listing of Product Installation	3.1													
			Plumbing Fixtures and Trim	2.2													
			Sanitary Drain, Waste, and Vent Fixtures	2.3													
			SD-10 Operation and Maintenance Data														
			Operation and Maintenance Manuals	3.3													
	15565		SD-06 Test Reports														
			Testing, Adjusting, and Balancing	3.2													

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TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF A C T I O N	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF A C T I O N
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		15565	SD-10 Operation and Maintenance Data														
			Operation and Maintenance Instructions														
		15720	SD-03 Product Data														
			Equipment and Performance Data	1.2													
			Unit Cabinet	2.2													
			Fan	2.3													
			Drain Pans	2.4													
			Insulation	2.5													
			SD-07 Certificates														
			Listing of Product Installations														
			Unit Cabinet	2.2													
			Fan	2.3													
			Drain Pans	2.4													
			Insulation	2.5													
			SD-10 Operation and Maintenance Data														
			Operation and Maintenance Manuals	3.3													
		15764	SD-01 Preconstruction Submittals														
			Material, Equipment, and Product Installation Lists	1.3													
			SD-02 Shop Drawings														
			Fabrication Drawings	1.3													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	BY (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)												
		15764	Installation Drawings	3.1													
			SD-03 Product Data														
			Equipment and Performance	1.3													
			Data														
			Coils	2.4													
			Casing	2.2													
			Enclosure														
			Motors	2.7													
			Fan	2.3													
			Drain Pans	2.5													
			Filters	2.6													
			SD-04 Samples														
			Manufacturer's Standard Color	1.3													
			Chart														
			SD-07 Certificates														
			Listing of Product Installations														
			Coils	2.4													
			Casing	2.2													
			Enclosure														
			Motors	2.7													
			Fan	2.3													
			Drain Pans	2.5													
			Filters	2.6													
			SD-10 Operation and Maintenance														
			Data														

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CONTRACT NO.

TITLE AND LOCATION Corrosion Control/AGE, Malmstrom AFB						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC NO	DESCRIPTION	PARAGRAPH #	GOVT CLASSIFICATION OR VIEW OR R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT (g)	BY (h)	BY (i)	ACTION (j)	DATE OF ACTION (k)		DATE RCD FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)			ACTION CODE (o)
		15764	Operation and Maintenance Manuals	3.3													
		15766	SD-01 Preconstruction Submittals														
			Material, Equipment, and Fixture List	1.4													
			Listing of Product Installations														
			SD-02 Shop Drawings														
			Propeller Unit Heaters	2.1.1													
			Cabinet Unit Heaters	2.1.2													
			SD-03 Product Data														
			Propeller Unit Heaters	2.1.1													
			Cabinet Unit Heaters	2.1.2													
			Casing														
			Fans														
			Motors														
			Propellers	2.1.1.4													
			Filters	2.1.2.4													
			Enclosures	2.1.2.5													
			Insulation														
			Vibration Isolation														
			SD-07 Certificates														
			Listing of Product Installations														
			Coils	2.1.2.2													
			Fans														
			Motors														
			Vertical Discharge Units														

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CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF ACTION	DATE RCD FROM CONTR	DATE FWD TO APPR AUTH/ TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF ACTION
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		15766	Horizontal Discharge Units														
			Propellers	2.1.1.4													
			SD-10 Operation and Maintenance														
			Data														
			Propeller Unit Heaters	2.1.1													
			Cabinet Unit Heaters	2.1.2													
		15815	SD-01 Preconstruction Submittals														
			Material, Equipment, and Fixture	1.5													
			Lists														
			SD-02 Shop Drawings														
			As-Built Drawings														
			SD-03 Product Data														
			Design Analysis and Calculations														
			Galvanized Steel Ductwork	2.1													
			Materials														
			Flexible Duct Materials	2.2													
			Flexible Connectors	2.8													
			Fire Dampers and Wall Collars	2.9													
			Gravity Backdraft and Relief														
			Dampers														
			Manual Volume Dampers	2.3													
			Louvers	2.6													
			Roof Hoods	2.7													
			SD-10 Operation and Maintenance														
			Data														

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CONTRACT NO.

TITLE AND LOCATION

Corrosion Control/AGE, Malmstrom AFB

CONTRACTOR

A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N C O D E	DATE OF ACTION		DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E	DATE OF ACTION		
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		15815	Operation and Maintenance Manuals	3.11													
			Fire Dampers and Wall Collars	2.9													
		15818	SD-01 Preconstruction Submittals														
			Material, Equipment, and Fixture Lists	1.5													
			Records of Existing Conditions	1.5													
			SD-02 Shop Drawings														
			As-Built Drawings	1.6													
			SD-03 Product Data														
			Equipment and Performance Data	1.2													
			Galvanized Steel Ductwork	2.1.1													
			Materials														
			Brazing Materials	2.1.2													
			Mill-Rolled Reinforcing and Supporting Materials	2.1.3													
			Round Sheet Metal Duct Fittings	2.2.1													
			Turning Vanes	2.2.4													
			Dampers	2.2.5													
			Flexible Connectors	2.2.6													
			SD-07 Certificates														
			Listing of Product Installations	3.2													
			Galvanized Steel Ductwork	2.1.1													
			Materials														
			Brazing Materials	2.1.2													

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CONTRACT NO.

TITLE AND LOCATION Corrosion Control/AGE, Malmstrom AFB						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT (g)	APPROVAL NEEDED BY (h)	MATERIAL NEEDED BY (i)	ACTION CODE (j)	DATE OF ACTION (k)		DATE RCD FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)			ACTION CODE (o)
	15818		Mill-Rolled Reinforcing and Supporting Materials	2.1.3													
			Round Sheet Metal Duct Fittings	2.2.1													
			Round, High-Pressure, Double-Wall Sheet Metal Ducts														
			Turning Vanes	2.2.4													
			Dampers	2.2.5													
			Flexible Connectors	2.2.6													
			SD-10 Operation and Maintenance Data														
			Operation and Maintenance Manuals	3.6													
	15819		SD-02 Shop Drawings														
			Heat Distribution System	1.3.1													
			SD-03 Product Data														
			Expansion Loops and Bends	2.2													
			Interruption of Existing Service	3.1.1													
			Work Plan														
			Connecting to Existing Work	3.1.3													
			SD-06 Test Reports														
			Operational Test	3.5.2.3													
			Tests	3.5													
			Certificate of Compliance														
			Welding	3.3													
			SD-10 Operation and Maintenance Data														

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TITLE AND LOCATION Corrosion Control/AGE, Malmstrom AFB						CONTRACTOR											
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF A C T I O N		DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			A C T I O N C O D E
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		15819	Heat Distribution System	1.3.1													
		15838	SD-02 Shop Drawings														
			As-Built Drawings	1.3													
			SD-03 Product Data														
			Equipment and Performance	1.3													
			Data														
			Housing														
			Fan	2.3													
			Motor	2.5													
			Bases	2.6													
			Roof Curbs	2.7													
			Dampers	2.8													
			Screens	2.9													
			SD-06 Test Reports														
			Tests	3.2													
		15840	SD-01 Preconstruction Submittals														
			Materials, Equipment, and Fixture	1.3													
			Lists														
			Records of Existing Conditions														
			SD-02 Shop Drawings														
			As-Built Drawings	1.3													
			SD-03 Product Data														
			Variable Constant-Volume Boxes	2.1													
			Variable Constant-Volume Boxes	2.1													
			SD-10 Operation and Maintenance														
			Data														

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TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		15840	Operation and Maintenance Manuals	3.3													
		15852	SD-01 Preconstruction Submittals														
			Material, Equipment, and Fixture Lists	1.2													
			SD-03 Product Data														
			Equipment and Performance Data	1.3													
		15940	SD-03 Product Data														
			Exhaust System Related Submittals														
			Ductwork Components	2.5													
			Materials and Equipment	2.8													
			SD-10 Operation and Maintenance Data														
			Exhaust System	1.6													
			Operation and Maintenance Manuals	3.4													
		15950	SD-01 Preconstruction Submittals														
			Records of Existing Conditions	1.3													
			SD-03 Product Data														
			Equipment and Performance Data	1.3													
			SD-06 Test Reports														
			Test Reports	1.3													
			SD-07 Certificates														

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CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		15950	Certificates	1.3													
		16065	SD-01 Preconstruction Submittals														
			Grounding Systems	3.7.2													
			SD-02 Shop Drawings														
			As-Built Drawings	1.4													
			SD-03 Product Data														
			Ground Rods	2.1													
			Ground Wires	2.2													
			Connectors and Fasteners	2.3													
			Bonding	3.6													
			SD-06 Test Reports														
			Bond Resistance Test	3.7.1													
			Ground Resistance Tests	3.7.2													
			Ground Isolation Test	3.7.3													
			Continuity Isolation Test	3.7.4													
			SD-08 Manufacturer's Instructions														
			Grounding Systems	3.7.2													
		16145	SD-01 Preconstruction Submittals														
			Conduit, Raceways and Fittings	2.1													
			Wire and Cable	2.2													
			Safety Switches	2.3													
			Flush Wiring Devices	2.4													
			Boxes and Fittings	2.5													
			Communication Cabinets														
			SD-02 Shop Drawings														
			Fabrication Drawings	1.4													

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CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		16145	Assembly Drawings	1.4													
			SD-03 Product Data														
			Conduit, Raceways and Fittings	2.1													
			Wire and Cable	2.2													
			Safety Switches	2.3													
			Flush Wiring Devices	2.4													
			Boxes and Fittings	2.5													
			Communication Cabinets														
			SD-06 Test Reports														
			Test Reports	3.7													
			SD-07 Certificates														
			Conduit, Raceways and Fittings	2.1													
			Wire and Cable	2.2													
			Safety Switches	2.3													
			Flush Wiring Devices	2.4													
			Boxes and Fittings	2.5													
			Communication Cabinets														
		16225	SD-02 Shop Drawings														
			Motors	2.1													
			SD-03 Product Data														
			Motors	2.1													
			Catalog Data	2.1													
			Rotor Bars	1.4													
			Stator Slots	1.4													
			Rotational Speed	1.4													
			Cooling Fan Blades	1.4													

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TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF A C T I O N	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF A C T I O N
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		16225	Bearing Manufacturer	1.4													
			Bearing Style	1.4													
			Bearing Type	1.4													
			Balls/Elements	1.4													
			Commutator Bars	1.4													
			Commutator Brushes	1.4													
			SCR Firing Frequencies	1.4													
			SD-07 Certificates														
			Factory Test Results	2.9													
			Efficiency	2.1													
			Efficiency	2.1.1													
			Power-Factor	2.9													
			Service Factor	2.8													
			Temperature Rating	2.5													
			Noise	2.9													
			Full-Load	2.3.1													
			Locked-Rotor	2.9													
			Insulation Resistance	2.9													
			Winding Resistance	2.9													
			High-Potential Tests	2.9													
			SD-08 Manufacturer's Instructions														
			Motors	2.1													
		16275	SD-02 Shop Drawings														
			Connection Diagrams	1.5													
			Fabrication Drawings	1.5													
			Installation Drawings	1.5													

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CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/	REMARKS	
						APPROVAL NEEDED	MATERIAL NEEDED		A C T I O N C O D E	DATE OF A C T I O N	DATE FWD TO APPR AUTH/	DATE FWD TO OTHER REVIEWER	DATE RCD FROM CONTR	DATE RCD FROM OTH REVIEWER			A C T I O N C O D E
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	SUBMIT (g)	BY (h)	BY (i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		16275	SD-03 Product Data														
			Equipment and Performance data	1.2													
			Equipment Foundation Data	1.2													
			Dry-Type Distribution Transformers	2.1.1													
			SD-06 Test Reports														
			Power Factor Tests														
			Insulation Resistance Tests	3.2.1													
			Insulation Power Factor (Doble) Tests	1.4													
			SD-07 Certificates														
			Certification	1.2													
			SD-10 Operation and Maintenance Data														
			Dry-Type Distribution Transformers	2.1.1													
			Pad-Mounted Liquid-Filled Distribution Transformers														
		16286	SD-02 Shop Drawings														
			Connection Diagrams	1.3													
			Fabrication Drawings	1.3													
			Control Devices	2.6													
			Control Devices	3.1													
			Protective Devices	2.1.3													
			Protective Devices	2.8													
			Protective Devices	3.1													

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TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF A C T I O N	DATE RCD FROM CONTR	DATE FWD TO APPR AUTH/ TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF A C T I O N
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		16286	SD-03 Product Data														
			Motor Control	2.1													
			Instrument Transformers	2.2													
			Enclosures	2.3													
			Circuit Breakers	2.4													
			Fuses	2.5													
			Control Devices	2.6													
			Control Devices	3.1													
			Time Switches														
			Protective Relays														
			Indicating Instruments	2.6.4.3													
			Indicating Lights	2.1.1													
			Indicating Lights	2.9													
			SD-06 Test Reports														
			Dielectric Tests	3.2													
			Timing Test	3.2													
			Insulation Power Factor Test	3.2													
			SD-07 Certificates														
			Circuit Tests	2.8													
			SD-08 Manufacturer's Instructions														
			Control Devices	2.6													
			Control Devices	3.1													
			Protective Devices	2.1.3													
			Protective Devices	2.8													
			Protective Devices	3.1													

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TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
		16286	SD-10 Operation and Maintenance Data														
			Manual Motor Controllers	2.1.1													
			Magnetic Motor Controllers	2.1.2													
			Combination Motor Controllers	2.1.3													
			High Voltage Motor Controllers														
			Circuit Breakers	2.4													
			Time Switches														
			Protective Relays														
			Indicating Instruments	2.6.4.3													
		16315	SD-01 Preconstruction Submittals														
			Material, Equipment and Fixture Schedule	1.4													
			SD-02 Shop Drawings														
			Fabrication Drawings	2.1													
			Installation Drawings														
			SD-03 Product Data														
			Crossarms and Timbers	2.3													
			Crossarm Braces	2.4													
			Hardware, Pins, and Racks	2.5													
			Insulators	2.6													
			Guys														
			Accessories	2.1													
			SD-07 Certificates														
			Crossarms and Timbers	2.3													
			Crossarm Braces	2.4													

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CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
		16315	Hardware, Pins, and Racks	2.5													
			Insulators	2.6													
			Guys														
			Accessories	2.1													
		16375	SD-02 Shop Drawings														
			Electrical Distribution System	3.8.3													
			As-Built Drawings														
			SD-03 Product Data														
			Fault Current Analysis		G												
			Protective Device		G												
			Coordination Study		G												
			Nameplates	2.2	G												
			Material and Equipment	2.1	G												
			General Installation	3.1	G												
			Requirements														
			SD-06 Test Reports														
			Factory Tests	2.15													
			Field Testing	3.8													
			Operating Tests	3.8.8													
			Cable Installation	3.2.1.4													
			SD-07 Certificates														
			Material and Equipment	2.1													
			Cable Joints														
			Cable Installer Qualifications														
			SD-10 Operation and Maintenance														
			Data														

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CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	BY (i)	A C T I O N C O D E	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E			DATE OF ACTION (p)
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		16375	Electrical Distribution System	3.8.3													
		16402	SD-02 Shop Drawings														
			Panelboards	2.11	G												
			Transformers	2.14	G												
			Cable trays		G												
			SD-03 Product Data														
			Receptacles	2.10													
			G]														
			Circuit breakers	2.11.3	G												
			Switches	2.8	G												
			Transformers	2.14	G												
			Motor controllers	2.16	G												
			Combination motor controllers		G												
			Manual motor starters	2.17	G												
			Metering		G												
			CATV outlets	2.20.1	G												
			Grounding Busbar	2.21.2	G												
			Surge protective devices	2.28	G												
			SD-06 Test Reports														
			600-volt wiring test	3.5.2	G												
			Grounding system test	3.5.5	G												
			Transformer tests	3.5.3	G												
			SD-07 Certificates														
			Fuses	2.9	G												
			SD-09 Manufacturer's Field Reports														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION	PARAGRAPH	CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT	BY	MATERIAL	ACTION	DATE OF ACTION		DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			ACTION
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		16402	Transformer factory tests	2.30.1													
			SD-10 Operation and Maintenance Data														
			Electrical Systems	1.5.1	G												
			Metering		G												
		16446	SD-02 Shop Drawings														
			Detail Drawings	1.2													
			Outline Drawings	1.2													
			SD-03 Product Data														
			Panelboards	2.1													
			Directory Card and Holder	2.3													
			SD-06 Test Reports														
			Continuity Tests	3.2													
			Insulation Tests	3.2													
			SD-07 Certificates														
			Statements	1.2													
			SD-08 Manufacturer's Instructions														
			Panelboards	2.1													
		16495	SD-03 Product Data														
			Equipment and Performance Data	1.3													
			Distribution Fuse Cutouts	2.1													
			Distribution Fuse Cutouts	2.2													
			Distribution Fuse Cutouts	3.1													
			SD-02 Shop Drawings														
			Fabrication Drawings	1.3													

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CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	BY (i)	A C T I O N C O D E	DATE OF A C T I O N (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E			DATE OF A C T I O N (p)
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		16495	Distribution Fuse Cutouts	2.1													
			Distribution Fuse Cutouts	2.2													
			Distribution Fuse Cutouts	3.1													
			SD-08 Manufacturer's Instructions														
			Fuse Cutouts	2.2													
		16511	SD-02 Shop Drawings														
			Fluorescent Lighting Fixtures	2.1													
			Fluorescent Lamp Ballast	2.4													
			Fluorescent Lamps	2.5													
			Outline Drawings	1.2													
			SD-03 Product Data														
			Fluorescent Lighting Fixtures	2.1													
			Fluorescent Lamp Ballast	2.4													
			Fluorescent Lamps	2.5													
			Manufacturer's catalog data	1.2													
			Compact Fluorescent Fixtures	2.3													
			SD-06 Test Reports														
			Test Reports	1.2													
			Lighting-Distribution Curves	1.2													
			SD-07 Certificates														
			Fluorescent Lighting Fixtures	2.1													
			Fluorescent Lamp Ballast	2.4													
			Fluorescent Lamps	2.5													
			Compact Fluorescent Fixtures	2.3													
			Efficiencies	2.1													
			Efficiencies	2.4													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION Corrosion Control/AGE, Malmstrom AFB						CONTRACTOR											
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E	DATE OF A C T I O N (k)		DATE RCD FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)			A C T I O N C O D E
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		16511	Efficiencies	2.5.1													
			Efficiencies	2.5.2													
			Efficiencies	2.5.3													
		16512	SD-01 Preconstruction Submittals														
			Material, Equipment, and Fixture Lists	1.2													
			SD-02 Shop Drawings														
			Installation Drawings	3.1													
			SD-03 Product Data														
			Commercial Lighting Fixtures	2.2													
			Industrial Lighting Fixtures	2.3													
			Lamp Ballasts	2.4													
			Lamps	2.5													
			SD-06 Test Reports														
			Operational Tests	3.2													
			SD-07 Certificates														
			Efficiencies	2.1.1													
		16524	SD-01 Preconstruction Submittals														
			Material, Equipment, and Fixture Lists	1.3													
			SD-02 Shop Drawings														
			Street-Lighting Fixtures	2.1													
			Lighting Standards	2.2													
			Street-Lighting Luminaires	2.3													
			Installation Drawings	3.2													
			SD-03 Product Data														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/		
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF A C T I O N		DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			A C T I O N C O D E
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		16524	Equipment and Performance Data	1.3													
			Equipment Foundation Data	3.1													
			Street-Lighting Fixtures	2.1													
			Lighting Standards	2.2													
			Street-Lighting Luminaires	2.3													
			SD-06 Test Reports														
			Operational Tests	3.2													
			SD-07 Certificates														
			Certificates	1.3													
		16529	SD-03 Product Data														
			Photoconductive Control Devices	2.1													
			Installation Drawings	1.2													
			Light-Sensitive Control Devices	2.1													
			SD-06 Test Reports														
			System Operation Tests	3.2													
			SD-08 Manufacturer's Instructions														
			Light-Sensitive Control Devices	2.1													
		16535	SD-01 Preconstruction Submittals														
			Material, Equipment, and Fixture Lists	1.2													
			SD-02 Shop Drawings														
			Central Emergency Lighting Systems														
			SD-03 Product Data														
			Emergency Lighting Egress Units	2.2													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	DATE OF ACTION	DATE OF ACTION	DATE OF ACTION	DATE OF ACTION				
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	SUBMIT (g)	BY (h)	BY (i)	(j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO OTHER REVIEWER (m)	DATE RCD FROM OTH REVIEWER (n)	(o)	DATE OF ACTION (p)	DATE RCD FRM APPR (q)	(r)
		16535	Emergency Fluorescent Lighting Accessories	2.3													
			SD-06 Test Reports														
			System Operational Tests	3.2													
			SD-07 Certificates														
			Emergency Lighting Egress Units	2.2													
			Emergency Fluorescent Lighting Accessories	2.3													
		16710	SD-02 Shop Drawings														
			Telecommunications drawings	1.5.1.1													
			G.														
			Telecommunications Space Drawings	1.5.1.2													
			SD-03 Product Data														
			Telecommunications cabling	2.3													
			G.														
			Patch panels	2.4.5													
			Telecommunications outlet/connector assemblies	2.5													
			Equipment support frame	2.4.2													
			Connector blocks	2.4.3													
			SD-06 Test Reports														
			Telecommunications cabling testing	3.5.1													
			G.														
			SD-07 Certificates														

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CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT	BY	BY	A C T I O N C O D E	DATE OF A C T I O N	DATE RCD FROM CONTR	DATE FWD TO APPR AUTH/ TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E			DATE OF A C T I O N
(a)	(b)	(c)	ITEM SUBMITTED (d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		16710	Telecommunications Contractor	1.5.2.1													
			G.														
			Key Personnel	1.5.2.2													
			Manufacturer Qualifications	1.5.2.3													
			Test plan	1.5.3													
			SD-09 Manufacturer's Field														
			Reports														
			Factory reel tests	2.10.1													
			G.														
			SD-10 Operation and Maintenance														
			Data														
			Telecommunications cabling and	1.9.1													
			pathway system														
			G.														
			SD-11 Closeout Submittals														
			Record Documentation	1.9.2													
			G.														
		16711	SD-02 Shop Drawings														
			Telecommunications Outside	1.6.1.1													
			Plant														
			G.														
			Telecommunications Entrance	1.6.1.2													
			Facility Drawings														
			SD-03 Product Data														
			Wire and cable	2.7													
			G.														

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CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Corrosion Control/AGE, Malmstrom AFB																	
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/	REMARKS	
						SUBMIT	BY	MATERIAL NEEDED	ACTION	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE FWD TO OTHER REVIEWER	DATE RCD FROM CONTR	DATE RCD FROM OTH REVIEWER			DATE OF ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		16711	Cable splices, and connectors	2.4													
			Closures	2.3													
			Building protector assemblies	2.2.1													
			Protector modules	2.2.2													
			Cross-connect terminal cabinets														
			SD-06 Test Reports														
			Pre-installation tests	3.4.1													
			G.														
			Acceptance tests	3.4.2													
			Outside Plant Test Plan	1.6.3													
			SD-07 Certificates														
			Telecommunications Contractor	1.6.2.1													
			G.														
			Key Personnel	1.6.2.2													
			Manufacturer's Qualifications	1.6.2.3													
			SD-08 Manufacturer's Instructions														
			Building protector assembly	2.2.1													
			installation														
			G.														
			Cable tensions	3.1.6.1													
			SD-09 Manufacturer's Field														
			Reports														
			Factory Reel Test Data														
			G.														
			SD-10 Operation and Maintenance														
			Data														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION Corrosion Control/AGE, Malmstrom AFB						CONTRACTOR											
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION	P A R A G R A P H	G O V T C L A S S I F I C A T I O N R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR	REMARKS	
						SUBMIT (g)	BY (h)	MATERIAL NEEDED (i)	A C T I O N C O D E (j)	DATE OF ACTION (k)	DATE RCD FROM CONTR (l)	DATE FWD TO APPR AUTH/ (m)	DATE RCD FROM OTH REVIEWER (n)	A C T I O N C O D E (o)			DATE OF ACTION (p)
	16711		Telecommunications outside plant (OSP)	1.6.1.1													
			G.														
			SD-11 Closeout Submittals														
			Record Documentation	1.8.1													
			G.														
	16713		SD-02 Shop Drawings														
			Fiber Optic System	1.4.1	G												
			SD-03 Product Data														
			Fiber Optic Media Types	2.1.1	G												
			Fiber Optic Splices	2.2	G												
			Fiber Optic Terminations and Connectors	2.4	G												
			Fiber Optic Enclosures	2.3	G												
			SD-06 Test Reports														
			Fiber Optic Factory Test Plan	1.4.5	G												
			Fiber Optic Field Tests Plan	1.4.6	G												
			SD-07 Certificates														
			Fiber Optic Cable Installer and Splicer Qualifications	1.4.2	G												
			Manufacturer's qualifications	1.4.4	G												
			SD-08 Manufacturer's Instructions														
			Fiber optic system instructions	1.4.3	G												
	16815		SD-02 Shop Drawings														
			Cable Television Premises		G												
			Distribution System														

CONTRACT NO.

Corrosion Control/AGE, Malmstrom AFB

CONTRACTOR:
SCHEDULE DATES

CONTRACTOR ACTION	
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APPROVING AUTHORITY

ACTIVITY
NO

TRANSMITTAL NO

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DESCRIPTION

PARAGRAPH

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APPROVAL

MATERIAL

ACTION CODE

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DATE FWD TO APPR AUTH/	
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~~REMARKS~~

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SECTION 01352

LEED REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section. Reference Section 01355 Environmental Protection.

1.2 SUMMARY

This Section includes general requirements and procedures for compliance with certain U.S. Green Building Council's (USGBC) LEED prerequisites and credits needed to ensure the Project to obtain LEED Certified certification.

Project is required to meet a minimum LEED "Certified" level.

Other LEED prerequisites and credits needed to obtain LEED certification are dependent on material selections and may not be specifically identified as LEED requirements.

Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests.

Additional LEED prerequisites and credits needed to obtain the indicated LEED certification are dependent on the Architect's design and other aspects of the Project that are not part of the Work of the Contract.

Related Sections include the following:

Divisions 1 through 16 Sections for LEED requirements specific to the Work of each of those Sections. These requirements may or may not include reference to LEED.

1.3 DEFINITIONS

LEED: Leadership in Energy & Environmental Design.

Rapidly Renewable Materials: Materials made from agricultural products that are typically harvested within a ten-year or shorter cycle. Rapidly renewable materials include products made from bamboo, cotton, flax, jute, straw, sunflower seed hulls, vegetable oils, or wool.

Locally/Regionally Manufactured Materials: Materials that are manufactured within a radius of 500 miles from the Project location. Manufacturing refers to the final assembly of components into the building product that is installed at the Project site.

Locally/Regionally Extracted, Harvested, or Recovered Materials: Materials that are extracted, harvested, or recovered and manufactured within a radius of 500 miles from the Project site.

Recycled Content: The percentage by weight of constituents that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (post-industrial), or after consumer use (post-consumer).

Spills and scraps from the original manufacturing process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product are not recycled materials.

Discarded materials from one manufacturing process that are used as constituents in another manufacturing process are post-industrial recycled materials.

1.4 SUBMITTALS

General: Submit additional LEED submittal requirements included in other sections of the Specifications.

LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

All LEED submittals to be compiled in a separate binder entitled "LEED Submittal Information." This document shall be updated weekly and shall be available for review on the job site at all times by a Contract Officer.

Unless otherwise noted, submittals to be submitted at Project Closeout.

SD-01 Project Materials Cost Data

Provide statement indicating total cost for building materials used for Project, excluding labor and profit. Include statement indicating total cost of mechanical and electrical components.

SD-02 LEED Action Plans

Provide preliminary submittals within 30 days of date established for Notice of Award indicating how the following requirements will be met.

1. Credit MR 2.1 and 2.2: Waste management plan complying with Section 01524 "LEED Construction Waste Management."
2. Credit MR 4.1 and 4.2: List of proposed materials with recycled content.
 - a. Indicate cost, post-consumer recycled content, and post-industrial recycled content for each product having recycled content.
3. Credit MR 5.1 and 5.2: List of proposed regionally manufactured materials and regionally extracted, harvested, or recovered materials.
 - a. Identify each regionally manufactured material, its source, and

- cost, excluding labor, profit, mechanical and electrical systems.
- b. Identify each regionally extracted, harvested or recovered material, its source, and cost.
4. Credit MR6: List of proposed wood-based products that are FSC certified.

SD-03 LEED Documentation Submittals

1. 1.0: Provide a site sediment and erosion control plan that conforms to best management practices in the EPA's Storm Water Management for Construction Activities, EPA Document No. EPA-832-R-92-005, Chapter 3. The plan shall meet the following objectives: Prevent loss of soil during construction by storm water run-off and/or wind erosion, including protecting topsoil by stockpiling for reuse. Prevent sedimentation of storm sewer or receiving streams and/or air pollution with dust and particulate matter. Provide the erosion control plan (or drawings and specifications) with the sediment and erosion control measures highlighted.
2. Credit WE 3.1 and 3.2: Product Data for plumbing fixtures indicating water consumption for each.
3. Prerequisite EA 3.0 and Credit EA 4: Product Data for new HVAC equipment indicating absence of CFC, HCFC, or Halon refrigerants or fire suppression systems.
4. Credit EA 5.0: Product Data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy and water consumption performance over time.
5. Credit MR 2.1 and 2.2: "LEED Construction Waste Management Plan" complying with Section 01524 and results.
6. Credit MR 4.1 and 4.2: Product Data and certification letter indicating percentages by weight of post-consumer and post industrial recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
7. Credit MR 5.1 and 5.2: Product Data indicating location of material manufacturer for regionally manufactured materials. Include statement indicating cost and distance from manufacturer to Project for each regionally manufactured material. Include statement indicating cost and distance from point of extraction, harvest, or recovery to Project for each raw material used in regionally manufactured materials.
8. Credit MR 7: Product Data for FSC certified wood.

A copy of the wood supplier's Chain of Custody certificate issued by an FSC-accredited certifying agency; and
A copy of the supplier's invoice detailing the quantities of certified wood products supplied for this project, with the FSC-certified status of each product listed in the individual line items; or
A copy of a letter from an FSC-accredited certifying agency corroborating that the products detailed on the wood supplier's invoice originate from certified well-managed forests.
Include statement indicating costs for each FSC certified product.
Submission of a Chain of Custody certificate without an invoice or submission of an invoice without a Chain of Custody certificate

shall not constitute acceptable documentation.

Proper procedures shall be followed to ensure that FSC-certified wood products are kept separate from non-certified materials and that auditing procedures as mandated by the certifier are complied with.

"Well-managed" shall mean forests that are being managed through professionally-administered forestry management and logging plans that ensure regeneration of desired species so that timber growth equals or exceeds harvesting rates in both quantity and quality over the long term. Other considerations include protecting rivers and streams from degradation, minimizing damage to the forest when harvesting, promoting biodiversity, operating in concert with the lawful interests of local populations, and maximizing both the yield and value of the forest products.

9. Credit EQ 1.0: Product Data and Shop Drawings for carbon dioxide monitoring system.

10. Credit EQ 4.1: Product Data for adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

11. Credit EQ 4.2: Product Data for paints and coatings used on the interior of the building indicating chemical composition and VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

12. Credit EQ 4.3: Product Data for carpet products indicating VOC content of each product used. Include statement indicating adhesives and binders used for each product.

13. Credit EQ 4.4: Product Data for composite wood and agrifiber products indicating that products contain no urea-formaldehyde resin.

Include statement indicating adhesives and binders used for each product.

14. Contractor to submit name of the LEED accredited professional providing coordination of sustainable construction activities.

1.5 QUALITY CONTROL

Contractor to comply with specific sustainable design requirements. Any work or documentation found not to be in compliance with the Contract is to be removed and replaced or corrected in an approved manner.

PART 2 PRODUCTS

2.1 RECYCLED CONTENT OF MATERIALS

1. Credits MR 4.1 and MR 4.2: Provide building materials with recycled content such that post-consumer recycled content constitutes a minimum of 10 percent of the cost of materials used for the Project or such that post-consumer recycled content plus one-half of post-industrial recycled content constitutes a minimum of 20 percent of the cost of materials used for the Project.

The cost of post-consumer recycled content of an item shall be determined by dividing the weight of post-consumer recycled content in the item by the total weight of the item and multiplying by the cost of the item.

The cost of post consumer recycled content plus one-half of post-industrial recycled content of an item shall be determined by dividing the weight of post-consumer recycled content plus one-half of pre-consumer recycled content in the item by the total weight of the item and multiplying by the cost of the item.

Do not include mechanical and electrical components in the calculation. Recycled content of materials shall be defined according to the Federal Trade Commission's "Guide for the Use of Environmental Marketing Claims," 16 CFR 260.7 (e).

2.2 LOCAL / REGIONAL MATERIALS

1. Credit MR 5.1: Provide 20 percent of building materials (by cost) that are regionally manufactured materials.

2. Credit MR 5.2: Of the regionally manufactured materials required by Paragraph "Credit MR 5.1" above, provide at least 50 percent (by cost) that are regionally extracted, harvested, or recovered materials.

2.3 FSC CERTIFIED WOOD

1. Credit MR 7: 50 percent of all wood-based products (by cost) shall be supplied and originate from forests that are certified "well-managed" by an agency accredited by the Forest Stewardship Council (FSC).

2.4 LOW-EMITTING MATERIALS

1. Credit EQ 4.1: For interior applications use adhesives and sealants that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24):

Wood Glues: 30 g/L.

Metal to Metal Adhesives: 30 g/L.

Adhesives for Porous Materials (Except Wood): 50 g/L.

Subfloor Adhesives: 50 g/L.

Plastic Foam Adhesives: 50 g/L.

Carpet Adhesives: 50 g/L.

Carpet Pad Adhesives: 50 g/L.

VCT and Asphalt Tile Adhesives: 50 g/L.

Cove Base Adhesives: 50 g/L.

Gypsum Board and Panel Adhesives: 50 g/L.

Rubber Floor Adhesives: 60 g/L.

Ceramic Tile Adhesives: 65 g/L.

Multipurpose Construction Adhesives: 70 g/L.

Fiberglass Adhesives: 80 g/L.

Structural Glazing Adhesives: 100 g/L.

Wood Flooring Adhesive: 100 g/L.

Contact Adhesive: 250 g/L.

Plastic Cement Welding Compounds: 350 g/L.

ABS Welding Compounds: 400 g/L.

CPVC Welding Compounds: 490 g/L.
PVC Welding Compounds: 510 g/L.
Adhesive Primer for Plastic: 650 g/L.
Sealants: 250 g/L.
Sealant Primers for Nonporous Substrates: 250 g/L.
Sealant Primers for Porous Substrates: 775 g/L.

2. Credit EQ 4.2: For interior applications use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24) and the following chemical restrictions:

Flat Paints and Coatings: VOC not more than 50 g/L.
Non-Flat Paints and Coatings: VOC not more than 150 g/L.
Anti-Corrosive Coatings: VOC not more than 250 g/L.
Varnishes and Sanding Sealers: VOC not more than 350 g/L.
Stains: VOC not more than 250 g/L.
Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
Restricted Components: Paints and coatings shall not contain any of the following:

Acrolein.
Acrylonitrile.
Antimony.
Benzene.
Butyl benzyl phthalate.
Cadmium.
Di (2-ethylhexyl) phthalate.
Di-n-butyl phthalate.
Di-n-octyl phthalate.
1,2-dichlorobenzene.
Diethyl phthalate.
Dimethyl phthalate.
Ethylbenzene.
Formaldehyde.
Hexavalent chromium.
Isophorone.
Lead.
Mercury.
Methyl ethyl ketone.
Methyl isobutyl ketone.
Methylene chloride.
Naphthalene.
Toluene (methylbenzene).
1,1,1-trichloroethane.
Vinyl chloride.

3. Credit EQ 4.4: Do not use composite wood and agrifiber products that contain urea-formaldehyde resin.

PART 3 EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT

1. Credit MR 2.1 and 2.2: Comply with Section 01524 "LEED Construction Waste Management."

-- End of Section --

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SECTION 01355

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.1 PERMITS AND FEES

1.2.1 No separate payment will be made for work covered under this section. The Contractor shall be responsible for payment of fees associated with environmental permits, application, and/or notices obtained by the Contractor. All costs associated with this section shall be included in the contract price. The Contractor shall be responsible for payment of all fines/fees for violation or non-compliance with Federal, State, Regional and local laws and regulations.

1.2.2 The Contractor shall be responsible for obtaining and complying with all environmental permits and commitments required by Federal, State, regional, and local environmental laws and regulations.

1.2.3 Demolition Work: Contractors shall notify the Montana Dept. of Environmental Quality, Permitting & Compliance Division, Air & Waste Management Bureau, P.O. Box 200901, Helena, MT. 59620-0901 for all demolition work where load bearing members are removed.

PART 2 NOT USED

PART 3 EXECUTION

3.1 AIR QUALITY

Equipment operation, activities, or processes performed by the Contractor shall be in accordance with all Federal and State air emission and performance laws and standards.

Burning of material is not allowed on base by the Contractor.

3.1.1 Particulates

The contractor shall not operate a construction site or demolition project unless reasonable precautions are taken to control emissions of particulate matter. Such emissions of airborne particulate matter shall not exceed 20% opacity as defined in 40 CFR 60 Appendix A.

3.1.2 Sound Intrusions

The Contractor shall keep construction activities under surveillance and control to minimize environment damage by noise. The Contractor shall

comply with the provisions of the State of Montana rules.

3.1.3 Ozone Depleting Chemicals (ODCs)

The Contractor shall ensure activities performed under this contract are in compliance with the Air Force Policy on ODCs. The contractor shall not purchase, use, nor specify the use of any Class I ODC in the production, design, or maintenance of the end item. Class II ODCs may be used or specified only with the written approval of the Contracting Officer. ODCs are identified and classified in Air Force Instruction (AFI 32-7080).

3.1.3.1 Air Conditioning & Refrigeration Equipment

Any maintenance, repair and demolition work to air conditioning and refrigeration equipment shall require that all CFC (Chlorofluorocarbons) handling standards be met. The contractor shall not furnish any equipment that requires the use of ozone depleting chemicals nor shall he vent or cause to be vented CFC or HCFC (Hydrochlorofluorocarbons) refrigerants or other mixtures containing CFCs to the atmosphere during repair, maintenance or demolition work on the equipment covered by this contract. The contractor shall have available refrigerant recovery or reclaim equipment to perform the work. Personnel who operate refrigerant reclaim or recycling equipment shall possess the necessary state and local certifications for operating the equipment. The contractor shall be responsible for meeting all requirements, permitting, licensing and certification required by state or local ordinance to work on refrigeration systems. Replacement compressors and other replacement equipment used in repairing CFC-containing systems shall be compatible with CFC replacement refrigerants.

3.2 WATER RESOURCES AND STORM WATER DISCHARGE

The Contractor shall monitor construction activities to prevent pollution of surface and ground waters. Toxic or hazardous chemicals shall not be applied to soil or vegetation unless otherwise indicated. The Contractor shall monitor all water areas affected by construction activities. For construction activities immediately adjacent to impaired surface waters, the Contractor shall be capable of quantifying sediment or pollutant loading to that surface water when required by State or Federally issued Clean Water Act permits.

3.2.1 Discharge into Storm Drain System

The contractor shall not discharge any contaminated materials into the storm drain system on Base. EPA authorizes the following non-storm water discharges: fire fighting activities; fire hydrant flushing; potable water sources; irrigation drainage; lawn watering; routine building wash-down without detergents; pavement wash-waters where spills/leaks of toxic or hazardous materials have not occurred and where detergents are not used; air conditioning condensate; springs; uncontaminated groundwater; and foundation/footing drains where flows are not contaminated with process materials such as hydrocarbons/solvents.

3.2.2 Sanitary Sewer

The Contractor shall not dump any restricted materials down the sanitary sewer or wastewater disposal system without approval of the Air Force. All discharges to the sewer shall meet Federal, State, and Local regulatory requirements and shall meet the permit requirements limiting MAFB discharges. The base sewer discharge is tested weekly by the City of Great Falls for conformance requirements.

3.2.2.1 Restricted waste water materials include those that create a fire or explosion hazard; are toxic or poisonous; waters or wastes having a pH lower than 5.5 or higher than 9.0; solid or viscous substances that can obstruct the sewer flow; interfere with the biological activity of a treatment plant; inhibit biological activity by increasing the temperature; any fats, wax, grease, or oils in excess of 100 mg/l, total petroleum hydrocarbons in excess of 25 mg/l, noxious or malodorous liquids; contain metals in excess of iron-0.03 mg/l, chromium-5.676 mg/l, copper-4.985 mg/l, cyanide-0.505 mg/l, zinc-1.019 mg/l, arsenic-0.462 mg/l, cadmium-3.551 mg/l, lead-0.946 mg/l, mercury-0.028 mg/l, nickel-4.782 mg/l or silver-0.531 mg/l, MAFB's industrial permit allowable limits; contain phenols or dyes; are radioactive; that contain over 100 lbs per day of total suspended solids (TSS) or five day biochemical oxygen demand (BOD) or cause the Base waste water discharge to exceed 200 mg/l BOD or 250 mg/l TSS.

3.2.2.2 For discharge of ground water, the Contractor shall surface discharge in accordance with all Federal, State, and local laws and regulations.

3.2.3 Storm Water Discharge Permit

3.2.3.1 Construction Activities-Storm water Discharge Permit - MPDES General Permit for Storm Water Discharges Associated with Construction Activity is required for construction activity in which clearing, grading and excavation will result in disturbance of 1 acre or more of land. A completed Notice of Intent (NOI) package must be sent to MDEQ and consists of the following:

- A. A Notice of Intent Form
- B. A Storm Water Pollution Prevention Plan. This plan must meet the basic requirements of the SWPPP provided in Part IV of the General Permit.
- C. Fees
- D. The NOI package shall be routed through the Civil Engineer Squadron Environmental Flight (341 CES/CEV) 10 days prior to construction start date.
- E. The SWPPP must be maintained on the construction site.
- F. During construction the contractor shall perform inspections as outlined in Part III of the General Permit.
- G. After the site has achieved final stabilization the contractor will

submit the Notice of Termination.

3.2.3.1.1 The contractor should reference the Montana Department of Environmental Quality's website:
<http://www.deq.state.mt.us/wqinfo/mpDES/stormwaterconstruction.asp> for Notice of Intent Forms, instructions, SWPPP information, and other guidelines for complying with Montana storm water requirements.

3.3 EROSION, SEDIMENT CONTROLS, AND WETLANDS

3.3.1 Wetlands - The Contractor shall not enter, disturb, destroy, place fill into, or allow discharge of contaminants into any wetlands except as specifically authorized herein. The Contractor shall be responsible for the protection of wetlands on Malmstrom AFB. Authorization to enter specific wetlands identified shall not relieve the Contractor from any obligation to protect other wetlands within, adjacent to, or in the vicinity of the construction site and associated boundaries. Maps showing locations of wetlands within Malmstrom AFB can be obtained from the 341 CES/CEV.

3.3.2 The Contractor shall be responsible for providing erosion and sediment control measures in accordance with Federal, State, and local laws and regulations. The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's construction activities. The area of bare soil exposed at any one time by construction operations should be kept to a minimum. The Contractor shall construct or install temporary and permanent erosion and sediment control best management practices (BMPs). BMPs may include, but not be limited to, vegetation cover, stream bank stabilization, slope stabilization, silt fences, construction of terraces, interceptor channels, sediment traps, inlet and outfall protection, diversion channels, and sedimentation basins. The Contractor's best management practices shall also be in accordance with the Base Montana Pollutant Discharge Elimination System (MPDES) Storm Water Pollution Prevention Plan (SWPPP) which may be reviewed at the Malmstrom AFB Environmental Office. Any temporary measures shall be removed after the area has been stabilized.

Design a Sediment and Erosion Control Plan, specific to the site, that conforms to United States Environmental Protection Agency (EPA) Document No. EPA 832/R- 92-005 (September 1992), Storm Water Management for Construction Activities, Chapter 3, OR local erosion and sedimentation control standards and codes, whichever is more stringent. The plan shall meet the following objectives:

1. Prevent loss of soil during construction by stormwater runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.
2. Prevent sedimentation of storm sewer or receiving streams.
3. Prevent polluting the air with dust and particulate matter.

See the LEED-NC Version 2.1 Reference Guide, published by the US Green

Building Council, for more information on how to meet these requirements.

3.4 TOXICS

The Contractor is responsible for ensuring that no employee is exposed to toxic materials like airborne asbestos, lead from lead base paint or polychlorinated biphenyls (PCB's).

3.4.1 Asbestos and Asbestos Hazards

The Contractor shall conform to all the requirements of 29 CFR 1926.1101, Occupational Exposure to Asbestos. Typical suspect asbestos containing materials include floor and/or ceiling tile, tile mastic, roofing materials and flashing mastics, pipe and boiler insulation, wall coverings, sheet rock joint compound, transite materials, etc.

3.4.1.2 No new asbestos containing materials shall be used or installed at any facilities under the jurisdiction of Malmstrom AFB.

3.4.1.3 The contractor shall notify the Montana Department of Environmental Quality, Permitting & Compliance Division, Air & Waste Management Bureau, Asbestos Control Program, PO Box 200901, Helena, MT. 59620-0901, of all demolition and renovation work where asbestos containing material removal quantities meet minimums specified for notification. (Demolition work is defined as any alteration of a structure where a load bearing beam is removed.) Notification is required for demolition work even though the facility contains no asbestos containing material (40 CFR 61.145(a)(2)).

3.4.2 Paint and Paint Hazards

3.4.2.1 Existing Paint: Existing painted surfaces may contain lead based paint. The Contractor is responsible for ensuring that no employee is exposed to concentrations of lead in excess of the permissible exposure limit (PEL) equal to an eight hour time weighted average of 50 micrograms per cubic meter (:g/m3). The Contractor shall conform to all the requirements of 29 CFR 1926.62 Lead Exposure in Construction. Workers are to wear respirators unless air testing establishes that lower protection factors are sufficient. Engineering and work practice controls may be sufficient to reduce exposure to or below the PEL. If the lead PEL is exceeded all workers shall wear appropriate personal protective equipment. The Contractor shall adhere to all other requirements of 29 CFR 1926.62. The Contractor shall keep a steady spray of water on any demolition work that may cause exposures. Runoff shall be contained on the work site to prevent contamination to any watersheds or the sanitary sewer system. The Contractor shall not contaminate the soil with lead due to excessive use of water. The site shall be limited to access by the public and the Contractor is responsible for non-exposure of the public to any lead concentrations above the PEL.

3.4.2.2 New-Paint Restriction - The Contractor shall not furnish or use any paints or coatings containing mercury or lead for interior or exterior applications.

3.4.2.3 No oil-based paints or coatings are to be used on base unless the entire liquid material is applied to the intended surface. No oil based paint liquid is to be left for disposal by base personnel nor is any of this material to be improperly disposed of by the contractor.

3.4.2.4 Use of environmentally safe water base paints and stains is recommended.

3.4.3 Polychlorinated Biphenyls (PCB's)

No PCB's or products containing PCB's shall be installed on Malmstrom AFB.

3.4.3.1 Turn in all light ballasts or electrical equipment with PCB's to the 341 CES/CEV. Transformers, capacitors, switching gear, etc., often contain PCB's for cooling purposes.

3.4.3.2 If hermetically sealed equipment, then turn in to 341 CES/CEV assuming it has a PCB concentration greater than the 500-ppm limit.

3.4.3.3 Contractor shall:

- a. Count the number of units for turn in.
- b. Place units in a 49 CFR 178.500, Subpart L shipping container furnished by him.
- c. Call 341 CES/CEV (Ph x6163) three days in advance to schedule contractor delivery.
- d. Deliver to appropriate storage facility.

3.5 HAZARDOUS MATERIALS (HAZMAT)

3.5.1 HAZMAT Contractor Authorization Procedures

3.5.1.1 Contractors must obtain an authorization prior to bringing any hazardous materials (as identified in Federal Standard 313D paragraph 3.2) onto Air Force installations. Following contract award, the contractor must identify all hazardous materials the contractor plans to use and the projected amounts to 341 CES/CEV through the contracting officer. 341 CES/CEV will review the submittal and identify those hazardous materials requiring formal HAZMAT authorization procedures. Some of these identified materials may be disapproved. All other materials on the list require no additional authorization. The standardized procedure for authorizing HAZMAT is explained in the HAZMAT Made Easy Guide and in AFI 32-7086. A copy of the HAZMAT Made Easy Guide will be provided to the contractor. For those materials requiring formal HAZMAT authorization procedures, the contractor will complete an AF Form 3952 Authorization Request Worksheet and attach the appropriate Material Safety Data Sheets (MSDS).

3.5.1.2 For hazardous materials requiring formal HAZMAT authorization procedures, the contractor will provide all AF Form 3952 worksheets and MSDS's to the base HAZMAT through the contracting officer. The HAZMAT will then enter the authorization request data into the HAZMAT tracking

system. The authorization will require 341 CES/CEV approval for environmental and emergency response purposes.

3.5.1.3 The contractor will report to the HAZMART for bar code issuance each time they bring formally authorized HAZMAT as described above onto the installation. The contractor will report on a monthly basis their consumption of these formally authorized hazardous materials to the HAZMART.

3.5.1.4 The contractor will maintain MSDS's for those hazardous materials requiring formal HAZMAT authorization procedures as described above. The MSDS's shall be on file at the construction site at all times.

3.5.1.5 Prior to completion of the contract, the contractor will submit a final report of the actual quantities used on base. The report will be used to reconcile actual chemical usage during the contract period. The contractor is responsible for the removal of all excess hazardous materials from the base and close out the HAZMART account. The contractor shall submit a HAZMART account close out report as a formal contract submittal.

3.5.1.6 The contractor shall submit all of the above data as a formal contract submittal.

3.6 EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW ACT (EPCRA)

For contracts over \$100,000, contractors shall comply with the Toxic Release Inventory reporting provisions of EPCRA Section 313 by filing Form R reports during the life of the contract. Contractors shall provide a list of any extremely hazardous or hazardous substances listed under EPCRA along with maximum inventory and consumption. HAZMART registration fulfills this requirement. Contractors shall provide this information to 341 CES/CEV and HAZMART. Should the potential contractor not be subject to reporting under EPCRA, he shall certify as such. References: Federal Register, August 10, 1995, Vol. 60, No. 154, p40987-40992 and Federal Register, September 29, 1995, Vol 60, No. 189, p50737-50743.

3.7 STORAGE OF HAZARDOUS MATERIALS

3.7.1 All hazardous materials used by the contractor on base property shall be stored properly in special areas in accordance with all regulatory and MAFB Fire Department requirements. Storage shall include, but not be limited to:

- A. Keep containers closed when not in use
- B. Label containers with warning labels
- C. Post hazardous signs as required
- D. Provide storage with secondary containment and routinely check for leaks and spills
- E. Store materials at a central location

F. Flammable items must be stored in an approved flammable storage locker

G. All fuel storage tanks must have secondary containment

H. Fuel and Lubricants

3.7.2 Storage, fueling and lubrication of equipment and motor vehicles shall be conducted in a manner that affords the maximum protection against spill and evaporation. Fuel, lubricants and oil shall be managed and stored in accordance with all Federal, State, Regional, and local laws and regulations. Used lubricants and used oil to be discarded shall be stored in marked corrosion-resistant containers and recycled or disposed in accordance with 40 CFR 279, State, and local laws and regulations. There shall be no storage of fuel on the project site. Fuel must be brought to the project site each day that work is performed.

3.8 HAZARDOUS WASTE PROCEDURES

3.8.1 Management and Disposal

All hazardous waste, except those that come under Universal Waste Rules, must be managed and disposed of in accordance with 40 Code of Federal Regulations (40 CFR) Subchapter I, Parts 260-268.

3.8.1.1 The contractor is responsible for the disposal of all hazardous waste generated from his operations, including spill cleanup. The contractor shall bear all costs associated with hazardous waste disposal.

3.8.1.2 Contractors storing hazardous waste on site for more than 24 hours must follow the Malmstrom Hazardous Waste Plan OPLAN 32-7042. As a minimum he must establish satellite accumulation points, appoint and train satellite accumulation point managers. If more than 55 gallons of hazardous waste or more than 5 lbs. of acutely hazardous waste is generated then the contractor must obtain approval for and establish a 90 day accumulation site.

3.8.1.3 The contractor shall manage his generated waste accumulations in accordance with 40 CFR Section 262.34 (c)(1). The contractor shall characterize (including sampling, analysis and manifesting) hazardous waste to a RCRA permitted facility. The contractor must arrange for a DOT trained and authorized person from the environmental flight to inspect the shipment and sign the hazardous waste manifest before manifesting the waste off base. The contractor shall provide a copy of the manifest to the 341 CES/CEV, Bldg 1708, prior to hazardous waste being shipped off the installation. A signed copy of the manifest must be returned to the 341 CES/CEV within 45 days.

3.8.1.4 The contractor is responsible for all fines and penalties, which may stem from an EPA or State of Montana Department Environmental Quality hazardous waste inspection of his operation.

3.8.2 Fluorescent Light Tubes

3.8.2.1 All fluorescent light tubes are considered hazardous waste even if they are sent to a recycling facility (unless there is data showing otherwise). Fluorescent tubes are to be managed in compliance with RCRA, 40 CFR Part 273, Universal Waste Rules and sent to recycling. All fluorescent light tubes shall be handled in such a way as to prevent breakage and the subsequent release of mercury-containing vapor. All tube removal related work shall be performed in conformance with all environmental, safety and health regulations.

3.8.2.2 Fluorescent light tubes shall be carefully removed from fixtures and packaged to prevent breakage during subsequent handling and shipping. If fluorescent bulbs are broken, then the contractor must cleanup immediately and the material must be treated as a hazardous waste. Broken bulbs must be managed under the provisions of 40 CFR, part 260. If bulbs are broken, they must be managed according to Paragraph 3.8.1.

3.8.2.3 Fluorescent tube recycling must be performed at a qualified recycling center that complies with 40 CFR 273 Subpart E standards for destination facilities. Upon completion of recycling, the Contractor must provide the Contracting Officer and 341 CES/CEVV certificates detailing the number of tubes recycled, date of recycling, and name and location of the recycler. Each certificate shall be signed and dated by the contractor removing the tubes and by the recycling firm performing the recycling.

3.8.3 The contractor may obtain guidance from the 341 CES/CEVV, 731-6163, on proper storage and handling of hazardous waste while on Malmstrom AFB. However, all responsibility rests with the contractor to comply with all federal and state hazardous waste requirements and any information obtained from the Environmental Flight does not remove responsibility from the contractor for proper waste management.

3.9 SOLID WASTES

3.9.1 The contractor is responsible for handling and disposal of all solid waste generated at the job site including laboratory testing and any documentation submittals required by the landfill owner.

3.9.2 Solid wastes (excluding clearing debris) shall be placed in containers that are emptied on a regular schedule. Handling, storage, and disposal shall be conducted to prevent contamination. Segregation measures shall be employed so that no hazardous or toxic waste will become co-mingled with solid waste. The Contractor shall transport solid waste off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal. A Subtitle D RCRA permitted landfill shall be the minimum acceptable off-site solid waste disposal option. The Contractor shall verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate.

3.9.3 Contractors are required to divert / recycle any solid waste generated from their work. The following on-site generated waste must be recycled: glass, tin, aluminum, cardboard, newspaper and office paper.

3.9.4 The Contractor shall make all arrangements for disposal of any

wastes including wastes requiring special handling such as asbestos and lead containing materials, rubble, sludge or non-hazardous chemical wastes.

3.9.5 Solid Waste Disposal Facilities

3.9.5.1 All non-hazardous wastes shall be properly disposed of through a licensed landfill or recycling center. Montana Dept of Environmental Quality written approval is required for any non-inert materials such as asphalt containing materials, asphalt roofing materials, steel containing materials, etc that are to be disposed of in a Class III landfill site. No written approval is required if a Class II or Class IV landfill site is used for disposal of these non-inert materials.

3.9.5.2 Class IV landfills accept Group VI wastes which include construction and demolition waste such as waste building materials, packaging, and rubble resulting from construction, remodeling, repair, and demolition operations on pavements (including asphalt waste), houses, commercial buildings, and other structures.

3.9.5.3 Regulated hazardous wastes are excluded from all Class II, III and IV landfill sites. Class II landfill sites can receive any wastes acceptable at Class III and Class IV landfill sites in addition to municipal and household solid wastes such as garbage and putrescible organic materials.

3.9.5.4 No landfill site is available on base. Demolition rubble shall not be buried or placed upon the land anywhere on base or at the work site.

3.9.5.5 The cost for cleanup of improperly disposed wastes and/or the costs for removals of improperly placed hazardous waste materials shall be the responsibility of the contractor.

3.9.5.6 Copies of all disposal documents and weight tickets shall be furnished to the Contracting Officer.

3.9.6 Non-Hazardous Solid Waste Diversion Report

The Contractor shall maintain an inventory of non-hazardous solid waste diversion and disposal of construction and demolition debris. The Contractor shall submit a report to the 341 CES/CEVV through the Contracting Officer ten days prior to the final acceptance inspection. The report "Waste Management Plan" is provided at Attachment 1 (1360-A).

3.10 AFFIRMATIVE PROCUREMENT

3.10.1 In compliance with the Affirmative Procurement requirements of Section 6002 of RCRA and Executive Order 13101, the Government requires the use of the recycled and recovered materials and products identified in the Environmental Protection Agency's Comprehensive Procurement Guidelines in all purchases.

3.10.1.1 These materials and products must meet the requirements of the specifications, must not delay the progress of the work, and must not be cost prohibitive.

3.10.2 EPA guideline items are seen as the minimum that should be considered when evaluating recycled/reuse materials. Other materials and products not listed, but commonly used in industry outside of the government should also be considered.

3.10.3 Material and product submittals for all recycled-content items required will list the recycled and recovered materials used and the percentage content.

3.10.4 Any decision not to acquire guideline items as required in the contract must be approved by the Contracting Officer. All purchases of guideline items must be verified by the Contracting Officer before contract closure. Activities subject to upward reporting and verification will be contracts with a total value over \$100,000.

3.10.5 Paper products such as government documents, agreements, contracts, etc. shall be printed on paper containing 30% post consumer materials. The use of bio-based or bio-based containing products is encouraged.

3.10.6 All contractually required documents and reports produced by or for the Air Force longer than two pages shall be double-sided.

3.11 SPILLS AND SPILL RESPONSE PROCEDURES

3.11.1 Spills of any type material (excluding clean water) shall be reported to the QAE and the 341 CES/CEVV, 731-6163, for evaluation to determine if cleanup is required and evaluate the need for reporting.

3.11.2 The contractor will be charged for any cleanups & disposal costs accomplished by Malmstrom civilian or contract personnel.

3.11.3 All spill cleanups will be completed in accordance with the Malmstrom AFB Integrated Hazardous Materials Emergency Response Plan OPLAN 32 4 and be handled by trained personnel only. Refer to the OPLAN 32-4 and 29 CFR 1910.120.

3.11.4 Any hazardous products or materials of environmental concern cleaned up on Malmstrom facilities must be tested to determine if it is a hazardous waste.

3.11.5 Spill Response procedures

3.11.5.1 Determine if the spill can be contained by the responsible organization. If it can be contained without injury to personnel and without assistance from response personnel. Observe the following: Contain and/or control the release. Clean up the release using proper absorbent media for the chemical spilled. Recover as much of the spill as possible using absorbent media or approved vacuum device to minimize hazardous waste volume. Do not hose down the spilled material into floor/storm drains. Report spill to the Contracting Officer and 341 CES/CEVV, 731-6163, for the proper reporting and guidance in the proper disposal of recovered material.

It is the contractor's responsibility to properly handle and dispose of clean up materials.

3.11.5.2 For spills beyond the capabilities of contractor personnel call the Base Fire Dept at 911.

3.11.5.3 Evacuate the area downwind of the spill if warranted by type of release.

3.11.5.4 Ensure all workers shut down their operations and secure their equipment, time permitting.

3.11.5.5 Stop source of spill with out undue risk of personal injury. Use on site containment, safety equipment, & materials.

3.12 DISCOVERY OF CONTAMINATED SOILS, MILITARY MUNITIONS, AND HISTORIC, ARCHAEOLOGICAL, OR CULTURAL RESOURCES

3.12.1 Contaminated Soil

If contaminated soil is encountered during any excavation work, the Spill Response procedure above shall be followed. Following site evaluation, the Contracting Officer will advise of the steps that the contractor must follow to complete the work through the contaminated area. This may include a requirement for 40 hour Hazardous Waste Operations and Emergency Response training, Confined Space Entry training and permitting, respiratory protection, and completion of a Site Safety & Health Plan. Any additional cost, not specified in the original contract, of work performed by the contractor in the contaminated area, shall be negotiated through the Malmstrom Contracting office.

3.12.2 Historical, Archaeological, and Cultural Resources

The Contractor shall protect Historical, Archaeological, and Cultural Resources and shall be responsible for their preservation during the life of the Contract. If during excavation or other construction activities any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found, all activities that may damage or alter such resources shall be temporarily suspended. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, paintings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, the Contractor shall immediately notify the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. The Contractor shall cease all activities that may result in impact to or the destruction of these resources. The Contractor shall secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources.

13.12.3 Military Munitions

In the event the Contractor discovers or uncovers military munitions as defined in 40 CFR 260, the Contractor shall immediately stop work in that

area and immediately inform the Contracting Officer.

-- End of Section --

I. Total Project Waste

Quantity (tons)	Landfill Site	Tip fee/ton	Total cost of disposal, including hauling, container rental, tip fees	Total cost/ton

From: _____
Project: _____
Date: _____

Type of Material	Quantity (tons)	Destination and means of transportation	Cost to handle and transport	Expected revenue & tip fee earnings	Net cost	Cost if landfilled	Comparison cost (+) / savings (-)
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[illegible]

V. Meetings to be held to address waste management

All similar materials will be grouped together based on the requirements of the recycling center. All dissimilar materials will be kept in separate containers/bins in order to avoid contamination.

At regularly scheduled jobsite coordination/progress meetings and at job safety meetings, waste management requirements will be discussed to clarify any confusion with the craftpeople.

RECOVERED MATERIALS WRITTEN DETERMINATION FORM

This form is needed only if item(s) being procured are subject to the installation's Affirmative Procurement Program for EPA-Designated Recycled Content Products.

The contracting officer must place in the contract file a written justification if an acquisition of EPA-designated products above the micro-purchase threshold does not contain recovered material. The procurement originator and/or contracting officer must check the appropriate justification(s), provide a written explanation, and sign and date the form.

Procurement Request / Project No. _____

EPA Designated Recycled Content Item NOT being Procured: _____

____ Designated Item is not competitively available within a reasonable period of time.
(If contract is greater than \$25,000, on DD Form 350, line B12F, choose "B.")

Need Date: _____ Date Available: _____

____ Designated Item is at an unreasonable price (recycled item costs more).
(If contract greater than \$25,000, on DD Form 350, line B12F, choose "C.")

Price of Designated Item: _____

Price of Non-Recycled Item: _____

____ Designated Item does not meet the installation's performance standards.
(If contract greater than \$25,000, on DD Form 350, line B12F, choose "D.")

Describe the performance need, document and section number and explain briefly why a recycled content product will not meet that need.

This written determination is made in accordance with FAR 23.405(c).

_____	_____	_____	_____
Procurement Originator Signature	Date	Contracting Officer Signature	Date

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SECTION 01451

CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 329	(2000b) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
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1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Bid Schedule.

1.3 LABORATORY VALIDATION

The testing laboratory shall be validated by Corps of Engineers Material Testing Center (MTC) for all tests required by contract. See paragraph 3.7 TESTS.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause titled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both onsite and offsite, and shall be keyed to the proposed construction sequence. The site project superintendent will be held responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with quality requirements specified in the contract. The site project superintendent in this context shall be the highest level manager responsible for overall construction activities at the site, including quality and production. The site project superintendent shall maintain a physical presence at the site at all times, except as otherwise acceptable to the Contracting Officer, and shall be responsible for all construction

and construction related activities at the site.

3.2 QUALITY CONTROL PLAN

3.2.1 General

The Contractor shall furnish for review and approval by the Government, not later than 10 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used. The Government will consider an interim plan for the first 60 days of operation. Construction will be permitted to begin only after Government Approval of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

3.2.2 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

- a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the project manager. If the project manager and project superintendent is the same person, the CQC System Manager shall report to someone higher in the Contractor's organization than the project manager.
- b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.
- c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the Government.
- d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01330 SUBMITTAL PROCEDURES.
- e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph

requiring test, feature of work to be tested, test frequency, and person responsible for each test. Laboratory facilities will be validated by the Corps of Engineers Material Testing Center and approved by the Contracting Officer.

f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.

h. Reporting procedures, including proposed reporting formats.

i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.

3.2.3 Acceptance of Plan

Government Approval of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.4 Notification of Changes

After approval of the CQC Plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.3 COORDINATION MEETING, (MUTAL UNDERSTANDING MEETING)

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. The CQC Plan shall be submitted for review a minimum of 5 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract

file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION

3.4.1 Personnel Requirements

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure safety and contract compliance. The Safety and Health manager shall receive direction and authority from the CQC System manager and shall serve as a member of the CQC staff. The Contractor shall provide a CQC organization which shall be at the site at all times during progress of the work and with complete authority to take any action necessary to ensure compliance with the contract. All CQC staff members shall be subject to acceptance by the Contracting Officer. The Contractor shall provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Complete records of all letters, material submittals, shop drawings submittals, schedules and all other project documentation shall be promptly furnished to the CQC organization by the Contractor. The CQC organization shall be responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

3.4.2 CQC System Manager

The Contractor shall identify as Contractor Quality Control (CQC) System Manager an individual within the onsite work organization who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be a graduate engineer, graduate architect, or a graduate of an approved 4-year construction management program, with a minimum of 5 years construction experience on projects similar to the subject contract or a highly experienced construction person with a minimum of 10 years of construction experience in work of comparative scope and complexity as the subject contract. This CQC System Manager shall be on the site at all times during construction and shall be employed by the prime Contractor. The CQC System Manager shall be assigned no other duties. An alternate for the CQC System Manager shall be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate shall be the same as for the designated CQC System Manager.

3.4.3 Additional Requirement

In addition to the above experience and education requirements the CQC System Manager shall have completed and possess a valid certificate for the course entitled "Construction Quality Management For Contractors". This course certificate remains valid for 2 years from course completion. After the two-year period the certification has expired and the course must be retaken in order to remain eligible to perform the duties of CQC System Manager. This course is periodically offered at AGC offices throughout the state of Washington and Oregon for a nominal fee.

3.4.4 Organizational Changes

The Contractor shall maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.5 SUBMITTALS AND DELIVERABLES

Submittals shall be made as specified in Section 01330 SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals are in compliance with the contract requirements. All Contractor forms for submitting test results are subject to Contracting Officer approval.

3.6 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control shall be conducted by the CQC System Manager for each definable feature of work as follows:

3.6.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

- a. A review of each paragraph of applicable specifications, reference codes, and standards. A copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field shall be made available by the Contractor at the preparatory inspection. These copies shall be maintained in the field and available for use by Government personnel until final acceptance of the work.
- b. A review of the contract drawings.
- c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.
- d. Review of provisions that have been made to provide required control inspection and testing.
- e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.
- f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.

- g. A review of the appropriate activity hazard analysis to assure safety requirements are met.
- h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.
- i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
- j. Discussion of the initial control phase.
- k. The Government shall be notified at least 48 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.6.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

- a. A check of work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.
- b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.
- c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
- d. Resolve all differences.
- e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
- f. The Government shall be notified at least 24 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.
- g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3.6.3 Follow-up Phase

Daily checks shall be performed to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon nor conceal non-conforming work.

3.6.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same definable features of work if the quality of on-going work is unacceptable, if there are changes in the applicable CQC staff, onsite production supervision or work crew, if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3.7 TESTS

3.7.1 Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements, see Table 1 - Minimum Testing, attached at the end of this specification section. Contractor shall submit all materials test reports on forms standard to industry standards such as ACI, ASTM and AASHTO or with laboratory accreditation forms such as AALA, NIST or NVLAP. Upon request, the Contractor shall furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers validated testing laboratory or establish a testing laboratory at the project site which can be validated by the Corps of Engineers in advance of any and all required testing; and in addition, submit proof of validation for approval. The Contractor shall perform the following activities and record and provide the following data:

- a. Verify that testing procedures comply with contract requirements.
- b. Verify that facilities and testing equipment are available and comply with testing standards.
- c. Check test instrument calibration data against certified standards.
- d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
- e. Results of all tests taken, both passing and failing tests, shall be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test shall be given. If approved by the Contracting Officer, actual test reports may be

submitted later with a reference to the test number and date taken. An information copy of tests performed by an offsite or commercial test facility shall be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.7.2 Testing Laboratories

3.7.2.1 Validation

The testing laboratory shall be validated by the Corps of Engineers Materials Testing Center (MTC) for all tests required by the contract prior to the performance of any such testing. The validation of a laboratory is site specific and cannot be transferred or carried over to a facility at a different location. Any and all costs associated with this Government laboratory validation shall be borne by the laboratory and/or the Contractor. Validation of a laboratory is not granted for the entire laboratory activity, but only for the specific procedures requested by the inspected laboratory. The inspected laboratory has full choice of the procedures to be inspected except that the Quality Assurance portion of ASTM E 329 is mandatory to be inspected.

(1) Validation Procedures

Validation of a laboratory may consist of either an inspection or audit as defined herein. Validation of all material testing laboratories shall be performed by the MTC. Validation may be accomplished by one of the following processes:

(a) Inspection. Inspection shall be performed by the MTC in accordance with American Society for Testing and Materials (ASTM) standards E329 and D3740.

(b) Audit. A laboratory may be validated by auditing if it has been accredited by the Concrete and Cement Reference Laboratory (CCRL) or AASHTO Materials Reference Laboratory (AMRL) within the past two years in accordance with ASTM E329. Audit shall be performed by the MTC. Inspection by MTC may be required after auditing if one or more of the critical testing procedures required in the project specification were not included in the CCRL or AMRL inspection report or if there is any concern that the laboratory may not be able to provide required services.

3.7.2.2 Standards of Acceptability

Aggregate, concrete, bituminous materials, soil, and rock. Laboratories for testing aggregate, concrete, bituminous materials, soil, and rock shall be validated for compliance with ASTM E 329, Engineer Manual (EM) 1110-2-1906, or project specifications, as applicable.

Water, sediment, and other samples. Laboratories engaged in analysis of water, sediment, and other samples for chemical analysis shall be inspected to assure that they have the capability to perform analyses and quality

control procedures described in references in Appendix A as appropriate. The use of analytical methods for procedures not addressed in these references will be evaluated by the CQAB for conformance with project or program requirements.

Steel and other construction materials, Laboratories testing steel and other construction materials shall be validated for capabilities to perform tests required by project requirements and for compliance with ASTM E329.

3.7.2.3 Validation Schedule

For all contracted laboratories and project Quality Assurance (QA) laboratories testing aggregate, concrete, bituminous materials, soils, rock, and other construction materials, an initial validation shall be performed prior to performance of testing and at least every two (2) years thereafter.

Laboratories performing water quality, wastewater, sludge, and sediment testing shall be approved at an interval not to exceed eighteen (18) months.

All laboratories shall be revalidated at any time at the discretion of the Corps of Engineers when conditions are judged to differ substantially from the conditions when last validated.

3.7.2.4 Validation Process

If a validated laboratory is unavailable or the Contractor selects to use a laboratory that has not been previously validated, Contractor shall coordinate with Corps of Engineers Material Testing Center (MTC) to obtain validation and pay all associated costs. Point of contact at MTC is Daniel Leavell, telephone (601) 634-2496, fax (601) 634-4656, email daniel.a.leavell@erdc.usace.army.mil, at the following address:

U.S. Army Corps of Engineers
Materials Testing Center
Waterways Experiment Station
3909 Hall Ferry Road
Vicksburg, MS 39180-6199

Procedure for Corps of Engineers validation, including qualifications and inspection/audit request forms are available at the MTC web site:

<http://www.wes.army.mil/SL/MTC/mtc.htm>

Contractor shall coordinate directly with the MTC to obtain validation. Contractor is cautioned the validation process is complicated and lengthy, may require an onsite inspection by MTC staff, correction of identified deficiencies, and the submittal and approval of significant documentation. Estimate a minimum of 60 days to schedule an inspection/submittal and receive a validation. Cost of onsite inspections is \$2500 plus travel time and cost from Vicksburg MS. Cost of audits is \$1500. If an onsite inspection is required following an audit, the cost of the inspection shall be \$1500 plus travel time and cost. The Contractor will be invoiced for actual travel costs and shall submit payment direct to the MTC made payable

to the ERDC Finance and Accounting Officer prior to the scheduling of the inspection and/or audit. The Contractor shall copy the Contracting Officer of all correspondence and submittals to the MTC for purposes of laboratory validation.

3.7.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.7.4 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials will be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to the Corps of Engineers Division Laboratory, f.o.b., at the following address:

U.S. Army Corps of Engineers
Materials Testing Center
Waterways Experiment Station
3909 Hall Ferry Road
Vicksburg, MS 39180-6199
Phone: (601) 634-2496 or (601) 634-3261

ATTN: Project _____, Contract Number _____

Coordination for each specific test, exact delivery location and dates will be made through the Area Office. If samples are scheduled to arrive at the laboratory on a weekend (after 1700 Friday through Sunday) notify the laboratory at least 24 hours in advance at (601) 634-2496 to arrange for delivery.

3.8 COMPLETION INSPECTION

3.8.1 Punch-Out Inspection

Near the completion of all work or any increment thereof established by a completion time stated in the Special Clause entitled "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the CQC System Manager shall conduct an inspection of the work and develop a punch list of items which do not conform to the approved drawings and specifications. Such a list of deficiencies shall be included in the CQC documentation, as required by paragraph DOCUMENTATION below, and shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final inspection.

3.8.2 Pre-Final Inspection

The Government will perform this inspection to verify that the facility is

complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected before notifying the Government so that a Final inspection with the customer can be scheduled. Any items noted on the Pre-Final inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph shall be accomplished within the time slated for completion of the entire work or any particular increment thereof if the project is divided into increments by separate completion dates.

3.8.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall be in attendance at this inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notice shall be given to the Contracting Officer at least 14 days prior to the final acceptance inspection and shall include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

3.9 DOCUMENTATION

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

- a. Contractor/subcontractor and their area of responsibility.
- b. Operating plant/equipment with hours worked, idle, or down for repair.
- c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
- d. Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.
- e. Quantity of materials received at the site with statement as to

acceptability, storage, and reference to specifications/drawings requirements.

f. Submittals reviewed, with contract reference, by whom, and action taken.

g. Off-site surveillance activities, including actions taken.

h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

i. Instructions given/received and conflicts in plans and/or specifications.

j. Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 24 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every 7 days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel. The QCS Daily Report, as specified in SECTION 01312 QUALITY CONTROL SYSTEM (QCS) is the official record.

3.10 SAMPLE FORMS

Sample forms are attached at the end of this specification section.

3.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

TABLE 1
MINIMUM SAMPLING AND TESTING FREQUENCY

Materials	Test	Minimum Sampling and Testing Frequency
<u>Fills, Embankments, Backfills, Subgrade, Subbase, and Base Course Material</u>		
Fill and Embankment	Field Density ^{2/12/}	Two tests per lift for each increment or fraction of 1,000 square yards and any time material type changes.
	Lab Density ^{3/}	One test initially per each type of materials or blended material and any time material type changes, and one every 10 field density tests.
	Gradation ^{1/}	One test every 200 cubic yards of fill foreach type of materials or blended material and any time material type changes.
Subgrade	Field Density ^{2/12/}	One test per each increment or fraction of 1,000 square yards.
	Lab Density ^{3/}	One test every 10 field density tests.
Backfill for Culverts, Trenches, Buildings and Walls, Pavements, and Other Structures	Field Density ^{2/12/}	Culverts: One test per each lift including subgrade.
		Trenches: One test per lift for each increment or fraction of 200 linear feet of backfill. Under pavements, one test every lift and at every crossing.
		Walls and Buildings Perimeters, Including Footings: One test per lift for each increment or fraction of 100 linear feet of backfill including subgrade

Buildings Slabs on Grade: One test per lift for each increment or fraction of 1,000 square feet.

Building areas or other areas enclosed by grade beams, compacted with power driven hand operated compactors: One test per lift for each increment or fraction of 500 square feet.

Pavements: Two tests per lift for each increment or fraction of 2,000 square yards.

Other Structures: One test per lift for each increment or fraction of 200 linear feet of backfill.

Lab Density³/

One test initially per each type of material or blended material and one every 10 field density tests.

Gradation¹/

One test per each type of material or blended material and one every 10 field density tests.

Subbase and Base

Gradation¹/(including .02 mm particles size limits.

1 sample for every 4,000 square yards.

Field Density²/ 12/

1 test every 2,000 square feet or fraction there of.

Moisture-Density Relationship³/

1 initially and every 20 density tests.

Subgrade, Subbase, and Base for Rigid and Flexible
Airfield Pavements and Heliports

Subgrade and Fill
or Embankment

In-Place Density¹²/

1 every 5,000 square yards (subgrade)

1 every 2,500 cubic yards and 1 for each type of material or an apparent change in moisture. (Fill or embankment)

	Moisture-Density Relationship	1 every 20 density tests or if material type changes.
	Gradation ^{1/}	1 every moisture-density test.
	Moisture	1 for every density test.
	Atterberg Limit	1 for every moisture-density test.
Subbase and Base Material	In-Place Density ^{12/}	1 every 2,000 cubic yards per lift (1 per day min.).
	Gradation (and Fractured Faces if applicable) ^{1/} tests.	1 every 2 in place density
	Moisture-Density Relationship	1 every 20 density tests.
	Moisture	1 for every density test.

Asphaltic and Portland Cement Concrete for Airfields

(See specifications for testing requirement)

Asphaltic Concrete and Pavements (Non airfield)

Asphaltic concrete	Marshall method Test	1 test per day minimum and 1 per 1,000 tons thereafter.
	Specific Gravity	1 per each Marshall Test.
	Extraction	1 test for each Marshall Method.
	Gradation ^{5/}	1 per each extraction test.
	Fracture faces ^{5/}	1 per each extraction test.
Cored or sawed specimens	Perform complete test (thickness, in-place density and bulk specific gravity) on each cored or sawed sample. ^{12/}	Take 1 set of 3 cored sawed specimens for each 1,000 square yards or fraction thereof.
		One specimen shall be taken from the longitudinal joint or from transverse joint.

Portland Cement Concrete (Non airfield)

Coarse and Fine Aggregate ^{7/}	Moisture, specific gravity and absorption ^{8/}	1 initially.
	Gradation and fineness modules	1 every 250 cubic yard of concrete.
	Moisture, specific gravity and absorption ^{8/}	(same as coarse aggregate).
Concrete	Slump	Conduct testing every day of placement. 1 test for 25 cubic yards or fraction there of and more frequently if batching appears inconsistent. Conduct with strength tests.
	Entrained Air	Conduct with slump test.
	Ambient and concrete temperatures	Conduct with slump tests.
	Unit weight, yield, and water cement ratio	Conduct with strength tests. Check unit weight and adjust aggregate weights to ensure proper yield.
	Flexural strength and evaluation	When specified for slabs on grade or for concrete pavements, take one set of 6 beams every 100 cubic yards of concrete with a minimum of 1 set per day. Two beams shall be tested at 7 days, two at 28 days, and two at 90 days.
	Compressive strength	One set of 3 cylinders for each day of placement. Samples and testing shall be performed on each 100 cubic yards increment or fraction there of. Additionally, one set of cylinders shall be collected and tested for each class of structural concrete. Test one cylinder at 7 days with the remaining cylinders tested at 28 days. Additional field cure

		cylinders shall be made when insitu strengths are required to be known.
Vibrators	Frequency and amplitude	Check frequency and amplitude initially and any time vibration is questionable.
Masonry		
Concrete Masonry Units	9/ Dry shrinkage	10/ 1 set of 3 per 10,000 units and manufacturers certification and test report.
	Airdry condition	11/ Same as dry shrinkage.
	Absorption	Same as dry shrinkage.
	Compressive strength	Same as dry shrinkage.
	Unit Weight	Same as dry shrinkage.
Mortar and grout	Compressive Strength	1 set of 3, every 2,000 units (1 test at 7 days and 2 tests at 28 days).

NOTES:

1/All acceptance tests shall be conducted from in-place samples.

2/Additional tests shall be conducted when variations occur due to the contractors operations, weather conditions, site conditions, etc.

3/Classification (ASTM D-2487), moisture contents, Atterberg limits and specific gravity tests shall be conducted for each compaction test if applicable.

4/Materials to be submitted only upon request by the Contracting Officer.

5/Tests can substitute for same tests required under "Aggregates" (from bins or source), although gradations will be required when blending aggregates.

6/Increase quantities by 50 percent for Paving mixes and by 100 percent for Government testing of admixtures. Include standard deviation for similar mixes from the intended batch plant and data from a minimum of 30 tests, if available. Refer to ACI 214.

7/A petrographic report for aggregate is required with the sample for source approval. If the total amount of all types of concrete is less than 153 cubic meters (200 c.y.) service records from three separate structures in similar environments which used the aggregates may substitute for the petrographic report.

8/Aggregate moisture tests are to be conducted in conjunction with concrete strength tests for w/c calculations.

9/For less than 1,000 units, the above test may be waived at the discretion of the Contracting Officer and acceptance based on manufacturers certification and test report.

10/Additional tests shall be performed when changes are made either in the manufacturing processes or in materials used in the production of the masonry units.

11/If adequate storage protection is not provided at the jobsite, additional tests shall be made to determine that the allowable moisture condition has not been exceeded before the blocks can be placed in the structure.

12/The nuclear densometer, if properly calibrated, may be used but only in addition to the required testing frequency and procedures using sandcones. The densometer shall be calibrated and is recommended for use when the time for complete results becomes critical.

(sample of typical Contractor's Daily Report, unless the use of QCS is specified, if QCS is specified refer to QCS specification)

DAILY CONSTRUCTION QUALITY CONTROL REPORT

Contract Number: _____ Date: _____ Rpt. No. _____

Contract Title: _____ Location: _____

Weather: Clear ___ P. Cloudy ___ Cloudy ___ Rainfall ___ (___% of workday)

Temperature during workday: High _____ degrees F. Low _____ degrees F.

1. WORK PERFORMED BY CONTRACTOR/SUBCONTRACTOR(S):

Contractor Name	No. of Workers	Crafts/Hours	Work performed
-----------------	----------------	--------------	----------------

2. EQUIPMENT DATA:

Type, Size, Etc.	Owned/Rented	Hours Used	Hours Standby
------------------	--------------	------------	---------------

3. QUALITY CONTROL INSPECTIONS AND RESULTS: (Include a description of preparatory, initial, and/or follow up inspections or meetings; check of subcontractors work and materials delivered to the site compared to submittals and/or specifications; comments on the proper storage of materials; include comments on corrective actions to be taken):

4. QUALITY CONTROL TESTING AND RESULTS (comment on tests and attach test reports):

--

5. DAILY SAFETY INSPECTIONS (Include comments on new hazards to be added to the Hazard Analysis and corrective action of any safety issues):

6. REMARKS (Include conversations with or instructions from the Government representatives; delays of any kind that are impacting the job; conflicts in the contract documents; comments on change orders; environmental considerations; etc.):

CONTRACTOR'S VERIFICATION: The above report is complete and correct. All material, equipment used, and work performed during this reporting period are in compliance with the contract documents except as noted above.

CONTRACTOR QC REPRESENTATIVE

(Sample of Typical Contractor's Test Report)

TEST REPORT

STRUCTURE OR BUILDING _____

CONTRACT NO. _____

DESCRIPTION OF ITEM, SYSTEM, OR PART OF SYSTEM TESTED:

DESCRIPTION OF TEST: _____

NAME AND TITLE OF PERSON IN CHARGE OF PERFORMING TESTS FOR THE CONTRACTOR:

NAME _____

TITLE _____

SIGNATURE _____

I HEREBY CERTIFY THAT THE ABOVE DESCRIBED ITEM, SYSTEM, OR PART OF SYSTEM
HAS BEEN TESTED AS INDICATED ABOVE AND FOUND TO BE ENTIRELY SATISFACTORY AS
REQUIRED IN THE CONTRACT SPECIFICATIONS.

SIGNATURE OF CONTRACTOR

QUALITY CONTROL INSPECTOR _____

DATE _____

REMARKS

-- End of Section --

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SECTION 01501

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.1 AVAILABILITY OF UTILITY SERVICES

1.1.1 Water

The Government will make available reasonable amounts of potable water to the Contractor, from existing outlets and supplies only, without charge. Contractor shall reasonably conserve potable water furnished. The contractor, at his own expense, shall install and maintain all necessary temporary connections and distribution lines as required for delivery of water to points of usage and shall remove these connections and lines prior to final acceptance of construction. Contractor shall restore the utility system to its original condition, and repair any damage to the utility caused by temporary connection.

1.1.2 Electricity

Subject to available supply, the Government will furnish reasonable amounts of electric power without charge from existing outlets and supplies. All temporary connections, equipment, and systems shall be installed and maintained in accordance with EM 385-1-1, the National Electric Code (NFPA 70), and the National Electric Safety Code (NESC). Skilled, licensed, electrical journeymen shall accomplish all work. The Contractor shall judiciously conserve electricity furnished. The Contractor, at his own expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain necessary temporary connections including transformers and related equipment as needed and shall remove this equipment and connections prior to final acceptance of the construction. The Contractor shall restore utility to original condition, and repair any damage to the utility caused by temporary connection. Government furnished electrical power shall not be used for temporary heat without the written approval of the CO. The government makes no guarantee that temporary connection to such utilities will be economical or feasible.

1.1.3 Natural Gas

The Government will make available to Contractor, from existing outlets and supplies, reasonable amounts of natural gas without charge. The Contractor shall judiciously conserve natural gas furnished. All temporary connections, equipment, and systems shall be installed and maintained in accordance with EM-385-1-1 and the American Gas Association (AGA) Manual. The Contractor, at his own expense, shall install and maintain necessary temporary connections and distribution lines and shall remove all temporary connections, equipment, and piping prior to final acceptance of construction. Contractor shall restore utility to original condition, and repair any damage to the utility caused by temporary connection. The government makes no guarantee that temporary connection to such utilities will be economical or feasible.

1.1.4 Sanitary Provisions

The Government will make available to Contractor, from existing outlets and supplies, access to sanitary sewer systems without charge. The contractor shall at his own expense install and maintain temporary connections and accommodations in accordance with all requirements of the State of Montana Health Department, Base Civil Engineer, other authorities having jurisdiction, and in accordance with the requirements of the Corps of Engineers Safety and Health Requirements Manual EM 385-1-1. The contractor shall at his own expense restore the utility to its original condition and repair any damage to the utility caused by temporary connection. Under no circumstances shall contaminated water as defined by RCRA, surface water, rainwater, waters related to dewatering activities, or similar be introduced into the sanitary sewer system. In the absence of sanitary facilities from existing outlets, the Contractor shall supply chemical toilets in accordance with the requirements of the Corps of Engineers Safety and Health Requirements Manual EM 385-1-1.

1.1.5 Telephone Service

Contractor shall make arrangements and pay all costs for telephone facilities desired including connection fees. Use of Government telephone service will not be permitted except in emergency situations or as otherwise approved by the Contracting Officer.

NOTE: All utility connections and details shall be as approved by the Contracting Officer's Representative prior to connection and use. The availability of government furnished utilities is subject to local availability and existing infrastructure. The government makes no guarantee that temporary connection to such utilities will be economical or feasible. The supply of government owned utilities or the lack thereof shall not be the basis for any claim against the government.

1.2 TEMPORARY ELECTRIC WIRING

1.2.1 Temporary Power and Lighting

The Contractor shall provide construction power facilities in accordance with the safety requirements of the National Electric Code NFPA No. 70 and the Safety and Health Requirements Manual EM 385-1-1. The Contractor, or his delegated subcontractor, shall enforce the safety requirements of electrical extensions for the work of subcontractors. Skilled, licensed, electrical journeymen shall accomplish all work.

Contractor shall provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

Contractor shall maintain lighting and provide all repairs.

1.2.2 Temporary Connections

The Contractor, at his own expense and in a manner satisfactory to the Contracting Officer, shall provide and maintain necessary temporary

connections and distribution lines. The Contractor shall notify the Contracting Officer, in writing, 5 working days before final electrical connection is desired. The Government will make the final hot connection after inspection and approval of the Contractor's temporary wiring installation. The Contractor shall not make the final electrical connection.

1.2.3 Submittals

The contractor shall obtain written approval from the Contracting Officer prior to making any utility connection. Submit detailed drawings of temporary power connections. Drawings shall include, but not be limited to, main disconnect, grounding, service drops, service entrance conductors, feeders, GFCI'S, natural gas connection, water connection, sanitary sewer connection, and all site trailer connections.

1.3 FIRE PROTECTION

During the construction period, the Contractor shall provide fire extinguishers in accordance with the safety requirements of the SAFETY AND HEALTH REQUIREMENTS MANUAL, EM 385-1-1. The Contractor shall remove the fire extinguishers at the completion of construction.

Prior to the start of flame cutting, welding, brazing, soldering, or similar open flame operations a Welding Cutting and Brazing Permit (AF Form 592) shall be procured in from the Malmstrom Air Force Base Fire Department. POC is the Dispatcher/Station Captain at (406) 731-3746. Depending on the location and hazards associated with the operation permits will be issued for varying periods of time.

1.4 UTILITY LOCATOR/IDENTIFICATION TAPE

Unless specified otherwise elsewhere in the Contract, all installed utility lines shall have a plastic marker tape minimum 150 mm wide and 0.125 mm thick, installed 200 mm to 260 mm below grade, and brightly colored. The plastic marker tape shall include a metallic wire or metal foil backing for detection purposes, and shall bear a continuous printed inscription describing the type of utility line buried below. All underground exterior gas lines shall be provided with a continuous tracer wire (#12 wire) taped to the pipe. Any existing marker tapes or tracer wires damaged during construction shall be repaired to original condition.

1.5 STAGING AREA

a. Contractor will be provided adequate open staging area adjacent to the site, as directed by the Contracting Officer. Staging areas are currently unsecured. The Contractor shall make provisions for his own security. All staging areas and storage areas shall be enclosed by a contractor installed, contractor furnished fence as specified in Section 01005 Site Specific Supplementary Requirements, paragraph 1.4 Construction and Staging Area Fence. The fence shall be gated and locked when not attended by the contractor's staff.

b. The Contractor shall be responsible for keeping his staging area

and office area clean and free of weeds and uncontrolled vegetation growth. Weeds shall be removed by pulling or cutting to within 6 inches of ground level. Lawn areas shall be mown to keep growth to less than 2-inches. All loose debris and material subject to being moved by prevailing winds in the area shall be picked up or secured at all times.

c. Temporary storage buildings (excluding tractor trailers) sited in the area shall conform to the base color scheme (Antique Linen, Fed. No. 23578). Architectural and structural features of all temporary facilities, including tractor trailers, shall be maintained in good repair as required by the Contracting Officer. Staging area shall be enclosed by chain link fence 6 feet high, with access gates. Spare keys to any locked gates shall be provided to the base Fire Department dispatch office. Area shall be kept clean, orderly and free of debris, demolished materials, etc. at all times. If the area is not maintained in a safe and clean condition as defined above, the Contracting Officer may direct the Contractor to perform such actions as necessary to bring the area and facilities up to base standards at no additional cost to the Government, or have the area cleaned by others with the costs being deducted from the Contractor's payment. Office trailers, storage trailers, and similar shall be blocked and anchored to the ground in accordance with EM 385-1-1 to prevent overturning during periods of high wind.

1.6 HOUSEKEEPING AND CLEANUP

Pursuant to the requirements of Clause CLEANING UP and Clause ACCIDENT PREVENTION, of the CONTRACT CLAUSES, the Contractor shall assign sufficient personnel to insure compliance. The Contractor shall submit a detailed written plan for implementation of this requirement. The plan will be presented as part of the pre-construction safety plan and will provide for keeping the total construction site, structures, and access ways free of debris and obstructions at all times. Work will not be allowed in those areas that, in the opinion of the Contracting Officer, have unsatisfactory cleanup and housekeeping at the end of the preceding day's normal work shift. At least once each day all areas shall be checked by the Quality Control person of the Contractor and the findings recorded on the Quality Control Daily Report. In addition, the Quality Control person shall take immediate action to insure compliance with this requirement. Housekeeping and cleanup shall be assigned by the Contractor to specific personnel. The name(s) of the personnel shall be available at the project site.

1.7 CONSTRUCTION NEAR COMMUNICATIONS CABLES

1.7.1 Excavation Near Communication Cables

Digging within 3 feet of buried communication cables (including fiber optic cables), electrical cables, and natural gas lines shall be performed by hand digging until the utility is exposed. The Project Inspector shall be notified 3 days prior to digging within a 3-foot area near this utility. A representative from Communications (Telco) must be present during excavation of Communications Cables. The cable piping routes must be marked prior to excavation in the area. A work clearance permit (AF Form

103) must be obtained from Base Civil Engineer Construction Management prior to any excavation work. Information on location of existing utilities will be available with the permit. Air Force personnel will locate the utilities only one time for digging permit purposes. It is the Contractor's responsibility from then on, through acceptance of the project. The Contractor shall be held responsible for any damage to the utility by excavation procedures. Once the utility is exposed, mechanical excavation may be used if there is no chance of damage occurring to the cable or piping systems.

1.7.2 Reburial of Exposed Utilities

When existing utility lines are reburied, a tape, detectable by pipe detector systems, shall be installed above the uncovered length of the utility. See paragraph UTILITY LOCATOR/IDENTIFICATION TAPE above for specific tape requirements.

1.7.3 Access to Communications Manhole or Handhole

No communications manhole or handhole shall be entered without first obtaining a fiber optic cable briefing. Coordinate through the Contracting Officer with the Base Communications Officer.

1.7.4 Cable Cuts or Damage

If a communications cable is cut or damaged the Contractor shall immediately notify the Contracting Officer (CO) and begin gathering personnel and equipment necessary to repair the cut, or damage. Contractor shall begin repairs within one hour of the cut or damage, unless notified otherwise, and continue repairs without interruption until full service is restored.

1.8 PROJECT SIGN

Contractor shall furnish and install one project sign in accordance with conditions hereinafter specified and layout shown on drawing No. 49s-40-05-15, Sheets 1 and 2, except Corps of Engineers' castle and Department of Air Force seal will be Government furnished. If construction occurs in more than one general location, a separate sign shall be required for each project area. All letters shall be block type, upper case. Letters shall be painted as indicated using exterior-type paint. Sign shall be maintained in excellent condition throughout the life of job. Project signs shall be located as directed. Upon completion of project, signs shall be removed and shall remain the property of Contractor.

1.9 ELEVATED WORK AREAS

Workers in elevated work areas in excess of 6 feet above an adjoining surface require special safety attention. In addition to the provisions of SAFETY AND HEALTH REQUIREMENTS MANUAL, EM 385-1-1, the following safety measures are required to be submitted to the Contracting Officer's Representative. Prior to commencement of work in elevated work areas, the Contractor shall submit drawings depicting all provisions of his positive fall protection system including, but not limited to, all details of

guardrails. Positive protection for workmen engaged in the installation of structural steel and steel joist shall be provided by safety nets, tie-offs, hydraulic man lifts, scaffolds, or other required means. Decking crews must be tied-off or work over nets or platforms not over 6 feet below the work area. Walking on beams and/or girders and the climbing of columns is prohibited without positive protection. Perimeter guardrails shall be installed at floor, roof, or wall openings more than 6 feet above an adjoining surface and on roof perimeters. Rails shall be designed to protect all phases of elevated work including, but not limited to, roofing operations and installation of gutters and flashing. Rails around roofs may not be removed until all work on the roof is complete and all traffic on or across the roof ceases. Rails shall be designed by a licensed engineer to provide adequate stability under any anticipated impact loading. As a minimum, the rails shall consist of a top rail at a height of 1 meter, a mid-rail, and a toe board. Use of tie-offs, hydraulic man lifts, scaffolds, or other means of roof edge protection methods may be utilized on small structures such as family housing, prefabricated metal buildings, etc. If safety belts and harnesses are used, the positive fall protection plan will address fall restraint versus fall arrest. Body belts will ONLY be used for fall restraint, they will not be used for fall arrest.

1.10 CONCEALED WORK

All items of work to be concealed shall be Government inspected prior to concealment.

1.11 REPAIR OF ROAD CUTS

Asphaltic surface shall be completely in place within 48 hours after placement of base gravel. Between placement of base gravel and pavement, road shall be kept in drivable and passable condition.

1.12 CONSTRUCTION PLANNING MEETINGS

Contractor shall attend a weekly scheduling meeting with the Contracting Officer's Representative and a representative of the using service. During the meeting, the Contractor shall be required to present in writing, and discuss his specific construction plans for, the following 2-week period. The first week's schedule shall be firm and the second weeks' schedule may be tentative and subject to change as conditions warrant. The schedule shall be detailed describing planned work activities, crew sizes and locations, and any utility and access restrictions to base activity which may be caused by planned construction. Any scheduling of outages will be performed at this meeting. Any Contractor activity affecting base security needs, such as scattered crews and number of workers per crew, will be detailed in the written schedule and discussed during the meeting. This weekly meeting is in addition to the construction progress charts or network analysis submission requirements.

1.13 TRAFFIC CONTROL PLAN

The Contractor shall submit an overall Traffic Control Plan for moving traffic through and around the construction zone in a manner that is conducive to the safety of motorists, pedestrians, and workers. This plan

shall indicate scheduling, placement, and maintenance of traffic control devices in accordance with the U.S. Department of Transportation, Federal Highway Administration publication, Manual on Uniform Traffic Control Devices. A specific plan depicting placement and type of signage, barricades, barriers, and related items shall be submitted to the government and approved a minimum of 2 weeks prior to each individual road closure, detour, or partial blockage of roadway, sidewalk, or bike path.

1.13.1 Government Approval

The Contractor shall submit a Traffic Control Plan to the Contracting Officer for approval and coordination with the Owner. The Contractor shall submit the Traffic Control Plan at least 15 working days prior to commencement of street or roadwork. No field work may be undertaken without specific approval Traffic Control Plan by the Contracting Officer. Streets (except dead end) may be closed to traffic temporarily (except at least one access lane shall be kept open to traffic) by approved written request to the Contracting Officer at least 10 working days prior to street closure. Excavations shall not remain open for more than 1 working day without approval.

1.14 UTILITIES NOT SHOWN

The Contractor can expect to encounter, within the construction limits of the entire project, utilities not shown on the drawings and not visible as to the date of this contract. The Contractor shall scan the construction site with electromagnetic or sonic equipment, and mark the surface of the ground where existing utilities are discovered. The Contractor shall verify the elevations of existing utilities, piping and any type of underground obstruction not indicated, or indicated and not specified to be removed. If such utilities interfere with construction operations, he shall immediately notify the Contracting Officer verbally and then in writing to enable a determination by the Contracting Officer as to the necessity for removal or relocation. If such utilities are removed or relocated as directed, the Contractor shall be entitled to equitable adjustment for any additional work or delay. The types of utilities the Contractor may encounter are waterlines, sewer lines (storm and sanitary), gas lines, fueling lines, steam lines, buried fuel tanks, septic tanks, other buried tanks, communication lines, cathodic protection cabling, and power lines. These utilities may be active or abandoned utilities.

1.15 GOVERNMENT WITNESSING AND SCHEDULING OF TESTING

The Contractor shall notify the Contracting Officer, by serial letter, of dates and agenda of all performance testing of the following systems: mechanical (including fire protection and EMCS) and electrical (including fire protection), a minimum of 10 calendar days prior to start of such testing. In this notification, the Contractor shall certify that all equipment, materials, and personnel necessary to conduct such testing will be available on the scheduled date and that the systems have been prechecked by him and are ready for performance and/or acceptance testing. Contractor shall also confirm that all operations and maintenance manuals have been submitted and approved. NO PERFORMANCE AND/OR ACCEPTANCE TESTING WILL BE PERMITTED UNTIL THE OPERATIONS AND MAINTENANCE MANUALS HAVE BEEN

APPROVED.

Government personnel, at the option of the Government, will travel to the site to witness testing. If the testing must be postponed or canceled for whatever reason not the fault of the government, the Contractor shall provide the Government not less than 3 working days advance notice (notice may be faxed) of this postponement or cancellation. Should this 3 working day notice not be given, the Contractor shall reimburse the Government for any and all out of pocket expenses incurred for making arrangements to witness such testing including, but not limited to airline, rental car, meals, and lodging expenses. Should testing be conducted, but fail and require rescheduling for any reason not the fault of the Government, the Contractor shall similarly reimburse the Government for all expenses incurred.

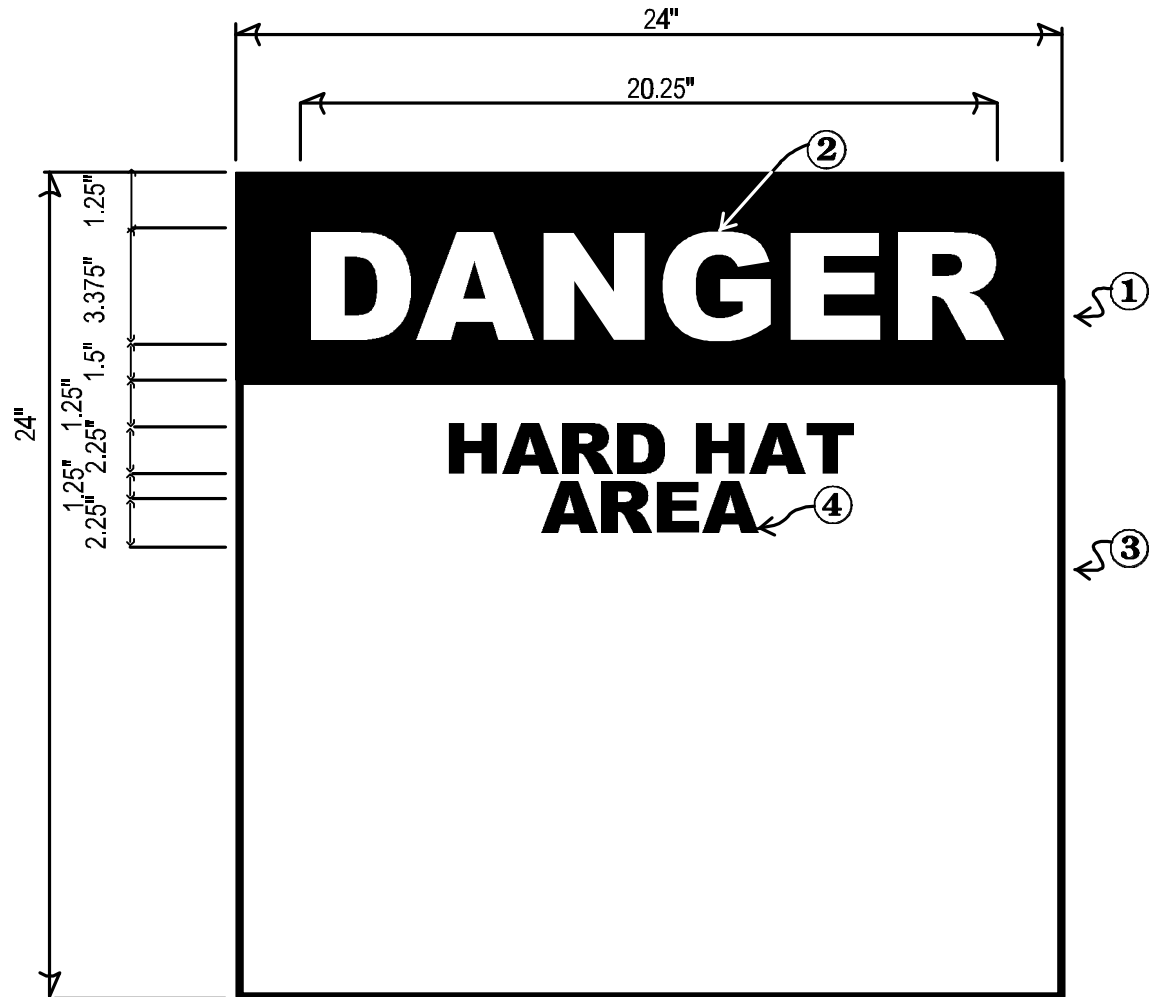
1.16 HARD HAT SIGNS

The Contractor shall provide 24 x 24 inch square Hard Hat Area signs at each entry to the project or work area as directed by the Contracting Officer. A minimum of two signs will be required. Signs shall be in accordance with the sketch in Section 01501 Attachment I - SIGNS. Additional construction signage is required to be attached to perimeter fencing or at the perimeter of the project area at 100-foot intervals. Additional signage requirements shall be in accordance with EM 385-1-1.

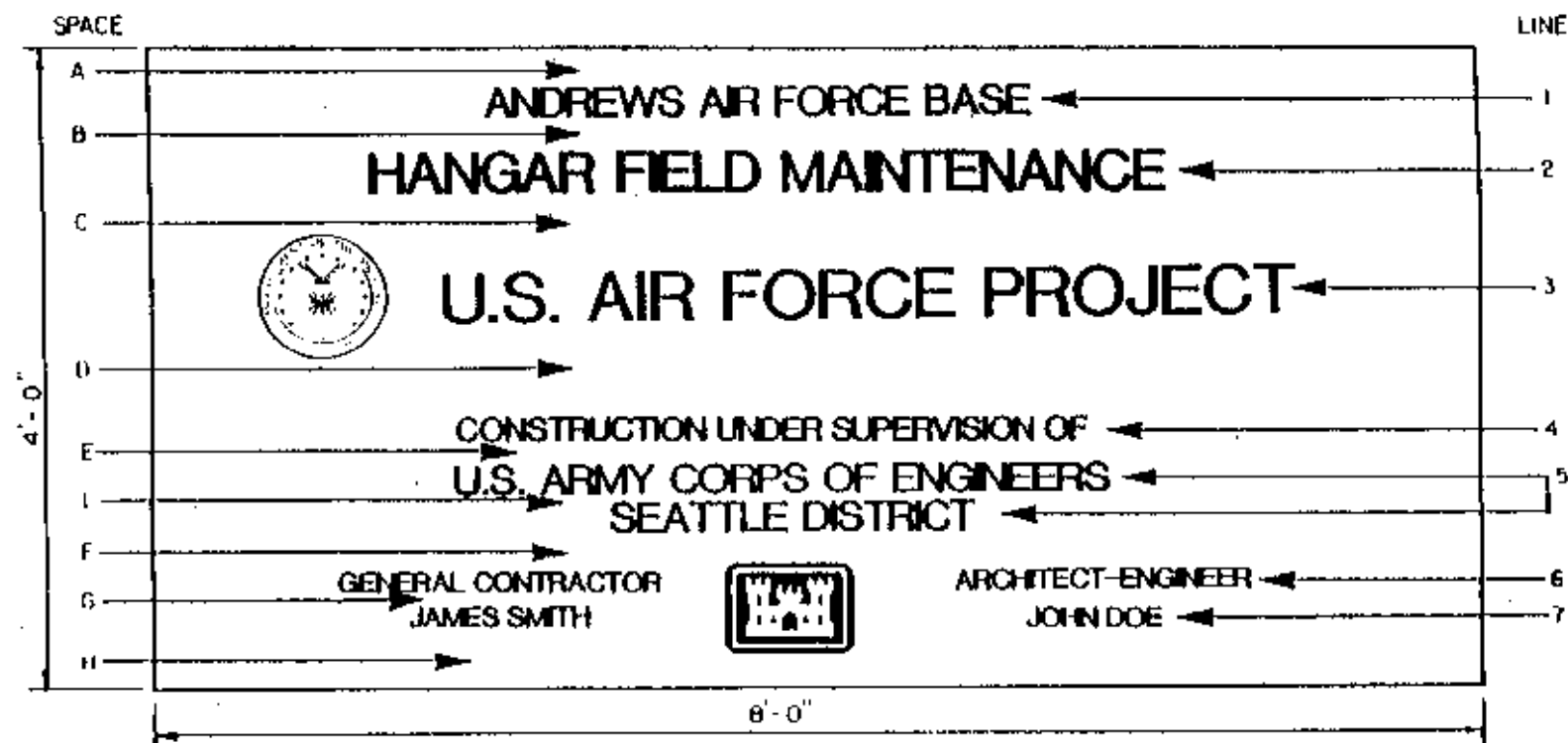
PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

-- End of Section --



- SIGN SHALL BE FABRICATED FROM .125 THICK 6061-T6 ALUMINUM PANEL
- COLOR
-
-
- - ① SAFETY RED (SR)
 - ② WHITE
 - ③ WHITE
 - ④ BLACK
- LETTERING SHALL BE HELVETICA BOLD TYPOGRAPHY.
- LETTERS AND BACKGROUND SHALL BE REFLECTIVE SHEETING MATERIAL.
- SIGNS SHALL BE POSTED AT 6'-6" (BOTTOM SIGN TO GRADE) OR AS DIRECTED BY THE CONTRACTING OFFICER.
- LETTERING TO BE CENTERED ON PANEL.



SAMPLE CONSTRUCTION SIGN FOR MCP PROJECTS

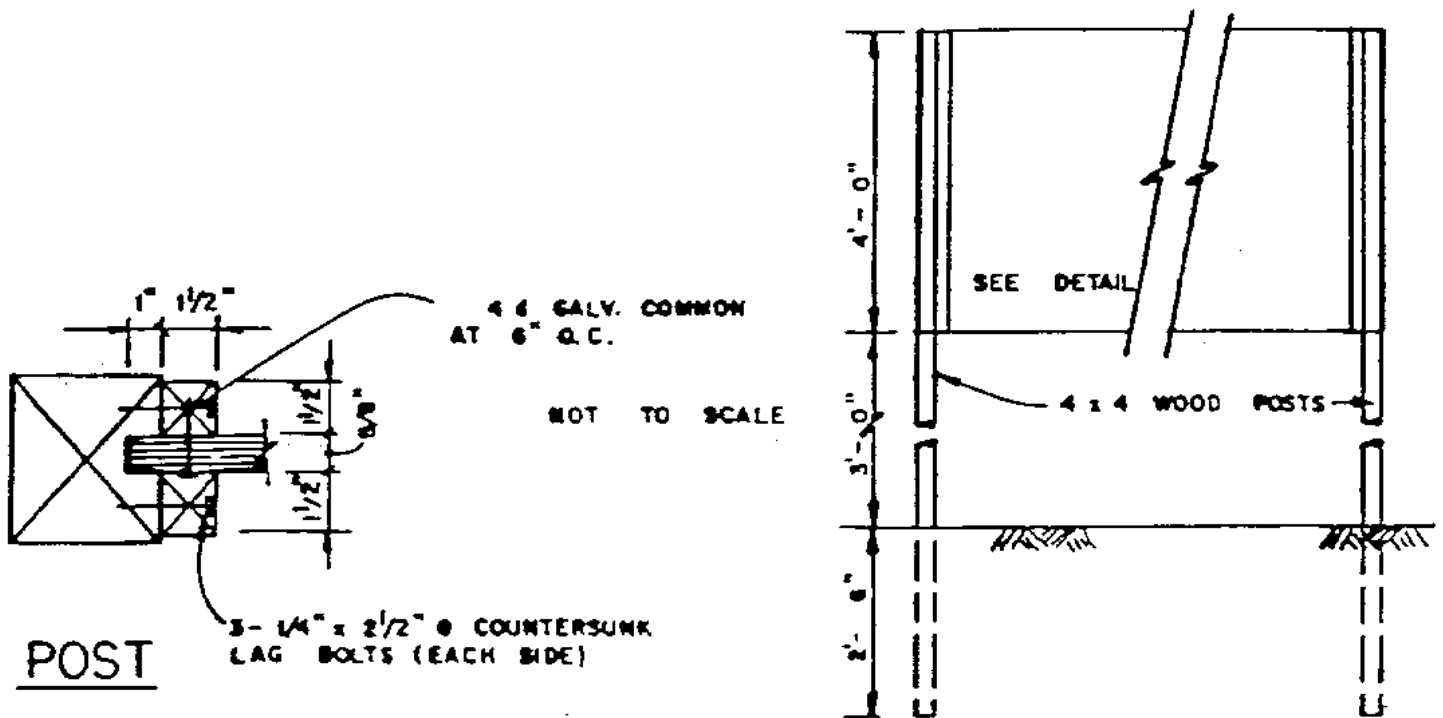
SCHEDULE

SPACE	HT.	LINE	DESCRIPTION	LETTER HT.	STROKE
A	2"	1	LOCATION	2 3/8"	1/4"
B	2 5/8"	2	PROJECT NOMENCLATURE *	2 3/4"	3/8"
C	5 3/4"	3	U.S. AIR FORCE PROJECT	4"	1/2"
D	8"	4	CONSTRUCTION UNDER SUPERVISION OF	1 1/2"	1/8"
E	4"	5	CONSTRUCTION AGENCY *	2 3/8"	1/4"
F	4"	6	GENERAL CONTRACTOR *	1 3/8"	3/16"
G	1"	7	GENERAL CONTRACTOR *	1 3/8"	3/16"
H	2 7/8"		* WILL VARY TO SUIT PROJECT REQUIREMENTS		
I	2"		SEATTLE DISTRICT		

U.S. AIR FORCE PROJECT CONSTRUCTION SIGN

Sheet 1 OF 2 See for Air above
 U.S. Army Engr. Dist. Seattle, WA.
 Dri R.L.W. Transmitted with report
 Tri R.L.W. DATED: 20 JUNE 84
 Cdr R.L.W. File No. 491/40-05-15

U.S. AIR FORCE PROJECT SIGN



NOTES:

1. Signboard 4' x 8' x 5/8" grade A-C exterior type plywood with medium density overlay on both sides.
2. Paint both sides and edges with one prime coat and two coats of paint, color white exterior type enamel. Lettering shall be as shown on drawing and shall be black gloss exterior type enamel.
3. Lettering shall be Helvetica medium.
4. Acceptable abbreviations may be used for Contractor's name.
5. Department of Air Force Seal and Corps of Engineers' Castle to be Government furnished.
6. No company logo shall be used.
7. Sign posts and 1 1/2" wood trim shall be painted white.
8. Upon completion of work under this contract, the project sign shall be removed from the job site and shall remain the property of the Contractor.

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SECTION 01701

OPERATIONS AND MAINTENANCE MANUALS

PART 1 GENERAL

1.1 GENERAL INFORMATION

Parts catalogs and operating instructions needed or useful in operation, maintenance, repairs, dismantling, or assembling, and for repair and identification of parts for ordering replacements, shall be especially prepared. The parts catalogs and operating instructions shall cover all equipment furnished under this contract and shall be assembled under a suitable common cover. The assembled material shall include complete identification of the spare parts furnished in compliance with the requirements of these specifications.

1.2 SUBMITTAL REQUIREMENTS

1.2.1 Preliminary O&M Manual And Data Submittal

1.2.1.1 General

To establish and assure uniform O&M manual format, the Contractor shall submit and receive Contracting Officer approval on three (3) complete sets of O&M data without the binders prior to submission of the final bound manuals. Initial O & M Manual data submittal shall be a minimum of 30 days prior to 90 percent project completion.

1.2.1.2 Review and Approval

The Contracting Officer will require thirty (30) days for review of submitted O&M manual(s) or data. The Contracting Officer will retain one copy of unacceptable O&M manual submittal and return remainder of copies to the Contractor marked "Returned for Correction." If "Returned for Correction." the Contractor shall resubmit the required number of copies of the manual(s) incorporating all comments, prior to substantial completion and/or use and possession. The Contractor may, at his option, update the copy retained by the Government in lieu of providing the added copy.

1.2.2 Final O&M Manual And Data Submittal

After final approval, four complete sets of the O & M manuals shall be provided for each separate building and individual project. Upon approval by the government, three of the four sets of manuals shall be transferred to the Malmstrom Project Office.

Within 30 days after the Final Inspection the remaining approved O & M manual set shall be placed by the contractor in the project's mechanical room or other location as designated by the COR. This O & M set shall be located on a contractor provided bookshelf and work surface assembly. The work surface and shelf assembly shall be securely mounted in a location approved by the COR. The work surface shall be with a sloped toward the

user and include a ½" high leading edge stop. The work surface shall be 15" deep by 36" long and mounted with the lower edge positioned 36" above finish floor. The bookshelf shall be mounted below the work surface with adequate vertical space for the manuals to clear the work surface above. The associated shelf shall be 12" deep and a minimum of 36" long or longer if needed to accommodate all volumes of the O&M set. The work surface and shelf assembly shall be made of white plastic laminate covered high-density particleboard or factory finished white 16-gauge steel. A shop drawing of this assembly shall be submitted for approval.

Two of the four completed copies of the final O&M manuals (for each building or equipment) shall contain original manufacturer's data. Data in the remaining manuals may be duplicated copies of original data. All data furnished must be of such quality to reproduce clear, legible copies.

1.2.2.1 Minimum Operation and Maintenance Manual Requirements

As a minimum O&M manuals are required for systems including Architectural, Fire Alarm and Fire Protection Systems, Mechanical, Mechanical Control, Landscape Irrigation, Electrical, and Communications. Other O & M manuals are required as specified elsewhere in the specifications.

1.3 FORMAT

Binders shall be premium grade three-ring, view type binders designed for 8 1/2 by 11 inch sheets. The background color of the binder shall be black. No binder shall exceed 2 inches in thickness. Should the quantity of data exceed the practical limit of a two-inch binder, additional volumes shall be provided. The binders shall be slant ring style; with view windows provided at the binder face and spine. The following identification shall be provided on the sheet insert for the binder face with similar information on a title page inside the binder:

1. The words "OPERATIONS AND MAINTENANCE MANUAL."
2. The name and location of the building, facility, and/or project.
3. The volume number in the format Volume 1 of 3.
4. The systems and/or equipment therein, i.e. Mechanical.
5. The name of the Contractor.
6. The contract number.
7. The year of completion of the contract.

In addition to the information required on the binder face sheet, the spine insert shall contain the following information:

1. The words "OPERATIONS AND MAINTENANCE MANUAL."
2. The name of the project.
3. The building number.
4. The systems and/or equipment therein, i.e. Mechanical.
5. The volume number in the format Volume 1 of 3.

1.3.1 Master Table Of Contents

Each manual shall contain a master table of contents. The master table of contents shall contain all chapters, appendixes, and a master index and shall be included in the front of the first volume if there is more than one volume. Each subsequent volume shall contain an index for the contents within that respective volume. Each volume shall not be broken between chapters, appendixes, and/or indexes. All chapters, appendixes, and indexes shall be adequately separated and identified by standard line indexes.

1.3.2 Drawings

One 11- by 17-inch copy of each of the drawings shall be furnished and shall be folded and bound for easy unfolding without removal from the binder. Each sheet in the binder shall be numbered and an index provided for ready reference to the data.

1.4 CONTENTS

1.4.1 Warning Page

A warning page shall be provided to warn of potential dangers (if they exist), such as high voltage, toxic chemicals, flammable liquids, explosive materials, carcinogens, or high pressures. The warning page shall be placed inside the front cover, in front of the title page.

1.4.2 Operation Data

The operation data shall include specific operating instructions, functional description of operating parts, and special precautions or procedures to be considered. The Contractor shall be responsible for the necessary coordination between his subcontractors, suppliers, and manufacturers to assure complete submittals on individual interrelated equipment components.

1.4.3 Maintenance Data

Maintenance data shall include instructions for inspection, testing, and maintenance; parts catalogs; and a list of special tools required.

1.4.4 Preventative Maintenance (PM) Charts

PM charts shall be developed and provided in the manual. These charts shall include the following:

1. Subject. A clear and descriptive name for the equipment requiring PM shall be given. Reference to shop drawings and catalog cuts shall be provided in a clear manner. "Checkpoints" shall be defined for each piece of equipment.
2. Procedure. A detailed procedural description of the method in which to perform PM shall be provided for all equipment requiring PM work. Safety precautions shall be provided. Descriptions of "checkpoints" shall be provided.
3. Dates. The PM charts shall include recommended PM intervals. The

intervals shall be defined as requiring PM either daily, weekly, monthly, quarterly, semiannually, or annually. These charts shall be inserted in an appendix at the end of the manual. This appendix shall be for PM charts only. PM shall include Inspection, testing, cleaning, replacement, and all routine maintenance work.

1.4.5 Warranties

In addition to the general warranty required by the contract, the O&M manuals shall include any specific warranties required by other sections of the TECHNICAL SPECIFICATIONS and other warranties normally provided with the particular piece of equipment or system. Extended warranties normally provided by manufacturers that are beyond the warranty of construction shall be specifically noted. The O&M manuals shall also include a specific warranty section itemizing all standard and extended warranty items. The warranty list shall be as indicated below. Warranties will not begin until the facility is accepted by the Contracting Officer. Copy of warranty shall be included in the manual.

1. WARRANTY INFORMATION

Project Title
Contract Number
General Contractors Name, Phone Number

2. ITEM DESCRIPTION START DATE END DATE O & M REFERENCE LOCATION (in alphabetical order)

Descriptive Name,
Manufactures/
Warrantors Name
Address & Phone No.

1.4.6 Installed Equipment Lists

A copy of the completed Equipment in Place forms required in SECTION 01705: EQUIPMENTIN-PLACE shall be included in the manual. The completed forms shall be located at the front of the catalog and O&M data for the equipment listed on the form.

1.4.7 Catalog Data Sheets And Spare Parts Listing

All catalog data sheets and the spare parts listing shall be inserted in an appendix at the end of the manual following the preventative maintenance (PM) charts appendix. This appendix shall be for catalog data sheets and the spare parts listing only. An index of the catalog data sheets shall be provided to provide clear and concise reference to shop drawings and individual pages within the manual.

Catalog data sheets shall be inserted into the manual such that positive identification of all parts on catalog data sheets are clearly identified by:

1. Part Name. A clear and descriptive name shall be given to each

component in the piece of equipment.

2. Manufacturer and Part Number. The name, address, and telephone number of the manufacturer shall be given along with the catalog part number. Standard catalog data sheets will not be acceptable unless irrelevant parts are marked out (with black "x") and relevant parts clearly identified. Any data on catalog sheets which does not directly relate to purchased equipment shall be marked out. Parts shall be so identified that they can be readily ordered from local area industrial supply outlets if not of special manufacture. A cross-reference between items described in catalogs, instructions, and drawings shall be provided to facilitate ease of location of parts described. Highlighting and "scribble notes" will not be acceptable for identification purposes.

The spare parts listing shall clearly state the spare parts supplied and a list of recommended spare parts to be stocked. The spare parts listing shall clearly identify:

1. Part Name. A clear and descriptive name shall be given to each component listed as a spare part in the piece of equipment.
2. Manufacturer and Part Number. The name, address, and telephone number of the manufacturer shall be given along with the catalog part number.
3. Quantity. The quantity of each part listed as a spare part shall be given.
4. Reference to Catalog Data Sheets. Each spare part shall be referenced to the corresponding catalog data sheet by page number.

1.5 PAYMENT

No partial or total payment will be made for the O & M manuals until all O&M manuals are fully approved by the Government (A or B action) and all copies of final manuals are received by the Government in their final binders (see the (Price) Schedule for details).

PART 2 PRODUCTS Not used.

PART 3 EXECUTION Not used.

-- End of Section --

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SECTION 01702

AS BUILT RECORDS AND DRAWINGS

PART 1 GENERAL

1.1 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures:"

SD-01 As-Built Field Data

Red Line Drawings; G

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 AS-BUILT FIELD DATA

3.1.1 General

The Contractor shall keep at the construction site two complete sets of full size prints of the contract drawings, reproduced at Contractor expense, one for the Contractor's use, one for the Government. During construction, both sets of prints shall be marked to show all deviations in actual construction from the contract drawings. The color red shall be used to indicate all additions and green to indicate all deletions. The drawings shall show the following information but not be limited thereto:

- a. The locations and description of any utility lines and other installations of any kind or description known to exist within the construction area. The location includes dimensions and/or survey coordinates to permanent features.
- b. The locations and dimension of any changes within the building or structure, and the accurate location and dimension of all underground utilities and facilities.
- c. Correct grade or alignment of roads, structures, and utilities if any changes were made from contract plans.
- d. Correct elevations if changes were made in site grading from the contract plans.
- e. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor including, but not limited to, fabrication erection, installation, and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.
- f. The topography and grades of all drainage installed or affected as part of the project construction.
- g. All changes or modifications from the original design and from the final inspection.

h. Where contract drawings or specifications allow options, only the option actually used in the construction shall be shown on the as-built drawings. The option not used shall be deleted.

These deviations shall be shown in the same general detail utilized in the contract drawings. Marking of the prints shall be pursued continuously during construction to keep them up to date. In addition, the Contractor shall maintain full size marked-up drawings, survey notes, sketches, nameplate data, pricing information, description, and serial numbers of all installed equipment. This information shall be maintained in a current condition at all times until the completion of the work. The resulting field-marked prints and data shall be referred to and marked as "As-Built Field Data," and shall be used for no other purpose. They shall be made available for inspection by the Contracting Officer's representative whenever requested during construction and shall be jointly inspected for accuracy and completeness by the Contracting Officer's representative and a responsible representative of the Contractor prior to submission of each monthly pay estimate. Failure to keep the As-Built Field Data (including Equipment-in-Place lists) current shall be sufficient justification to withhold a retained percentage from the monthly pay estimate.

3.1.2 Submittal of the As-Built Field Data

Two sets of the full size As-Built Field Data shall be submitted to the Contracting Officer for review and approval a minimum of 20 calendar days prior to the date of final inspection. If review of the preliminary as-built drawings reveals errors and/or omissions, the drawings will be returned to the Contractor for corrections. The Contractor shall make all corrections and return the drawings for backcheck to the Contracting Officer within 10 calendar days of receipt. When submitted drawings are accepted, one set of marked drawings will be returned to the Contractor for the completion of the as-built drawings.

3.2 AS-BUILT ELECTRONIC FILE DRAWINGS

3.2.1 No earlier than 30 days after award the Government will have available for the Contractor one set of AutoCAD *) electronic file format contract drawings, to be used for preparation of as-built drawings. The electronic file drawings will be available on either 89 mm (3-1/2 inch) 1.44 MB floppy disks or ISO-9660 CD-ROM, as directed by the Contracting Officer. The Contractor has 30 days after the receipt of the electronic file to verify the usability of the AutoCAD files, and bring any discrepancies to the attention of the Contracting Officer. Any discrepancies will be corrected within 15 days and files returned to the Contractor. The Contractor shall incorporate all deviations from the original contract drawings as recorded in the approved 'As-built Field Data' (see paragraph 3.1.2). The Contractor shall also incorporate all the written modifications to the contract drawings which were issued by amendment or contract modification. All revisions and changes shall be incorporated, i.e. items marked "deleted" shall be deleted, clouds around new items shall be removed, etc.

3.2.2 No later than 30 days after final acceptance a complete set of as-built drawings shall be submitted in AutoCAD *) electronic file format.

The electronic file format, layering standards and submittal requirements are specified in paragraphs below. The as-built drawings shall be done in a quality equal to that of the originals. Line work, line weights, lettering, and use of symbols shall be the same as the original line work, line weights, and lettering, and symbols. If additional drawings are required they shall be prepared in electronic file format under the same guidance. When final revisions have been completed, each drawings shall be identified with the words "AS-BUILT" in block letters at least 3/8-inch high placed above the title block if space permits, or if not, below the title block between the border and the trim line. The date of completion and the words "REVISED AS-BUILT" shall be placed in the revision block above the latest revision notation.

3.2.3 Electronic File Submittal Requirements

3.2.3.1 The AutoCAD electronic file(s) deliverable shall be in AutoCAD release 2000 'DWG' binary format. All support files required to display or plot the file(s) in the same manner as they were developed shall be delivered along with the files. These files include but are not limited to Font files, Menu files, Plotter Setup, and Referenced files. The AutoCad files shall be "bound" (merged). It is the Contractor's responsibility to translate the design Microstation files to AutoCad files for as-built drawings.

3.2.3.2 Leveling shall remain as provided in the electronic files. An explanatory list of which levels are used in each drawing, including any additional levels needed to complete incorporation of the As-Built data, shall be provided with each submittal.

3.2.3.3 Electronic File Deliverable Media:

All electronic files shall be submitted in ISO 9660 format CD-ROM (CD). Zip drive disks shall not be provided. Two complete sets of CD(s) shall be submitted along with one complete set of 1/2 size prints taken from the CD(s). See paragraph 3.2.4 below. Each CD shall have a clearly marked label stating the Contractor's firm name, project name and location, submittal type (AS-BUILT), and date the CD was made. Each submittal shall be accompanied by a hard copy transmittal sheet that contains the above information along with tabulated information about all files submitted, as shown below:

<u>Electronic File Name</u>	<u>Plate Number</u>	<u>Drawing Title</u>
-----------------------------	---------------------	----------------------

Electronic version of the table shall be included with each submittal set of disks.

3.2.4 Submittal of the Final As-Built Drawings

The final as-built record drawings shall be completed and returned together with the approved preliminary as-built drawings to the COE, Seattle District Office, Technical Branch, Records and Information Section, within 30 calendar days of final acceptance. All drawings from the original contract drawings set shall be included, including the drawings where no

changes were made. The Government will review all final as-built record drawings for accuracy and conformance to the drafting standards and other requirements contained in DIVISION 1 GENERAL REQUIREMENTS. The drawings will be returned to the Contractor if corrections are necessary. The Contractor shall make all corrections and shall return the drawings to the same office within 7 calendar days of receipt.

3.3 All costs incurred by the Contractor in the preparation and furnishing of as-built drawings in electronic file format shall be included in the contract price and no separate payment will be made for this work. Approval and acceptance of the final as-built record drawings shall be accomplished before final payment is made to the Contractor.

3.4 As Built Prints

One set of marked-up as-built prints shall be furnished at the time of system acceptance testing. These as-built prints shall be in addition to the submittals of marked-up as-built prints specified elsewhere in the contract.

MHAFFB CIVIL ENGINEERING CAD LAYERING STANDARDS

GENERAL GUIDELINES

1. There will be no numerical layer names. All layers will be in an abbreviated format; example: utilities = util, text = txt.
2. All New buildings will be located by their Geodetic Coordinates.
3. All blocks will be created on layer 0.
4. The Contractor shall provide all projects in .DWG file format compatible with autoCAD Release 13 (or Microstation 5.0, if so directed by the Contracting Officer) on 89 mm (3-1/2 inch) floppy disks: low or high density is acceptable.
5. The Contractor shall provide a typed copy of layer names, limits, Lt scale, pen configurations, etc., and contents submitted as part of the Design Analysis and the final submittal of the disks.
6. All information shall be drawn at full scale. (1:1)
7. All text shall be in mono.

MANDATORY LAYER NAMES (CIVIL SITE PLANS ONLY)

LAYER NAME	TO INCLUDE	COLOR
------------	------------	-------

BORDER	Border, Title Block, N Arrow, Scale	8 (Dark Grey)
--------	-------------------------------------	---------------

TXT	Title Block, Text, Notes, Dims	11 (Dark Green)
-----	--------------------------------	-----------------

STRUCT	Bldg. Outlines	4 (Cyan)
--------	----------------	----------

STRUCT T	Bldg. Numbers	(Red)
----------	---------------	-------

CONTOURS	Index & Intermediate	Index/ 4 (Cyan)
		Intermediate/ 1 (Red)

UTILS	All	7 (White)
-------	-----	-----------

PAVED	Paved Roads	2 (Yellow)
-------	-------------	------------

PAVED T	Street Names	1 (Red)
---------	--------------	---------

UNPAVED	Unpaved Roads	1 (Red)
---------	---------------	---------

Any specific questions regarding layering standards may be referred to the project engineer.

RECOMMENDED LAYER TITLES

Proposed Layers for a CIVIL/SITE Drawing:

Layer List: O (Not Used), BORDER, KEYMAP, SITEPLAN, FTPRINT, SOILBOR, CONTOURS, GRADING, LANDSCP, LAWNspr, PAVING, WATER, SEWER, STDRAIN, ELECT, COMM, PHONE, NATGAS, SECTIONS, DETAILS, DEMOL, NEW, DIMS, TXT, MISC

Proposed Layers for a FOUNDATION Drawing:

Layer List: O (Not Used), BORDER, DEMOL, EXISTING, NEW, DIMS, TXT, MISC, KEYMAP, FDPLAN, SECTIONS, DETAILS, MISC

Proposed Layers for an ARCHITECTURAL Drawing:

Layer List: O (Not Used), BORDER, KEYMAP, FLPLAN, DOORS (SWINGS), WDWS, DIMS, TXT, DEMOL, NEW, SECT, DETAILS, SCHED, INTEL, MISC

Proposed Layers for a STRUCTURAL Drawing:

Layer List: O (Not Used), BORDER, KEYMAP, FLPLAN, DEMOL, NEW, BLDGSECT, STRDET, DIMS, TXT, MISC

Proposed Layers for a Roof Drawing:

Layer List: O (Not Used), BORDER, KEYMAP, FLPLAN, ROOFPLAN, ROOFRMG, DEMOL, NEW, DIMS, TXT, MISC

Proposed Layers for an EXTERIOR ELEVATIONS Drawing:

Layer List: O (Not Used), BORDER, KEYMAP, NELEV, SELEV, EELEV, WELEV, DIMS, TXT, MISC

Proposed Layers for a MECHANICAL DRAWING:

Layer List: O (Not Used), BORDER, KEYMAP, FLPLAN, DIMS, TXT, WATER, SEWER, HVAC, SPRINKLER, SCHED, MISC

Proposed Layers for a HVAC Drawing:

Layer List: O (Not Used), BORDER, KEYMAP, FLPLAN, DIMS, TXT, HVAC, CONTROLS, SCHED, MISC

Proposed Layers for a LIGHTING Drawing:

Layer List: O (Not Used), BORDER, KEYMAP, FLPLAN, ELED, DIMS, TXT, DIAG/SCHEM (DIAGRAMS/SCHEMATICS), SCHED, MISC

Proposed Layers for an ELECTRICAL Drawing:

Layer List: O (Not Used), BORDER, KEYMAP, FLPLAN, ELECT, DIMS, TXT, DETAILS, DIAGRAMS, SCHED, MISC

Proposed Layers for a COMMUNICATIONS / TELEPHONE Drawing:

Layer List: O (not Used), BORDER, KEYMAP, FLPLAN, PHONEJCK, COMMDEV, CIRCUITS, PANELS, DIMS, TXT, DETAILS, DIAGRAMS, SCHED, MISC

-- End of Section --

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SECTION 01703

WARRANTY OF CONSTRUCTION

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Equipment Warranty Identification Tag Schedule; G

Equipment Identification Nameplate Schedule; G

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 WARRANTY OF CONSTRUCTION (APR 1994) (FAR52.246-21)

3.1.1 In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph 3.1.9 of this Clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

3.1.2 This warranty shall continue for a period of 1 year from the date of final acceptance of the work or beneficial occupancy by the owner. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

3.1.3 The Contractor shall remedy at the Contractor's expense, any failure to conform, or any defect. In addition, the Contractor shall remedy, at the Contractor's expense, any damage to Government-owned or controlled real or personal property, when that damage is the result of:

- a. the Contractor's failure to conform to contract requirements or
- b. any defect of equipment, material, workmanship, or design furnished.

3.1.4 The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of

repair or replacement.

3.1.5 The Government will notify the Contractor, in writing or by telephone, after the discovery of any failure, defect, or damage. The Contractor shall furnish, and maintain, a 24 hour emergency telephone number as the point of contact. For failures, defects, or damage causing loss of power, heating, air conditioning or air distribution the Contractor shall respond and mitigate the problem within 4 hours and twenty four (24) hours for all other systems.

3.1.6 If the Contractor fails to remedy any failure, defect, or damage within 5 working days after receipt of notice, the Government will have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

3.1.7 With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall:

- a. obtain all warranties that would be given in normal commercial practice;

- b. require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and

- c. enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

3.1.8 In the event the Contractor's warranty under paragraph 3.1.2 of this clause has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

3.1.9 Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage that results from any defect in Government-furnished material or design.

3.1.10 This warranty shall not limit the Government's rights under the Inspection of Construction clause of this contract with respect to latent defects, gross mistakes, or fraud.

3.2 ADDITIONAL WARRANTY REQUIREMENTS

3.2.1 Pre-Warranty Conference

Prior to contract completion and at a time designated by the Contracting Officer the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of the Paragraph: WARRANTY OF CONSTRUCTION. Communication procedures for the Contractor notification of warranty defects, priorities with respect to the type of defect and other details deemed necessary by the Contracting Officer for the execution of the construction warranty shall be established/reviewed at this time. The Contractor will furnish the name, telephone number and

address of the service representative who is authorized to initiate and pursue warranty work action on behalf of the Contractor. This single point of contact will be located within the local service area of the warranted construction, will be continuously available, and will be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any contractual responsibilities in connection with the paragraph WARRANTY OF CONSTRUCTION.

NOTE: Local service area is defined as the area in which the Contractor or his representative can meet the response times as described in paragraph WARRANTY OF CONSTRUCTION and in any event shall not exceed 200 miles radius of the construction site.

3.2.2 Equipment Warranty Identification Tags

The Contractor shall provide warranty identification tags on all Contractor and Government furnished equipment that is Contractor installed. (Same equipment as listed on the Equipment-In-Place List required under Section 01705 EQUIPMENT-IN-PLACE LIST).

The tags and information shall be suitable for interior and exterior locations, resistant to solvents, abrasion, and to fading caused by sunlight, precipitation, etc. These tags shall have a permanent pressure-sensitive adhesive back, and shall be installed in a position that is easily noticeable. If the equipment surface is not suitable for adhesive back tags, the Contractor shall submit an alternative to the Government for review and approval. Contractor furnished equipment that has differing warranties on its components will have each component tagged/identified.). Lettering on the tags shall be block-type upper case and easily readable. Tags shall be similar in format to the following:

EQUIPMENT WARRANTY CONTRACTOR FURNISHED EQUIPMENT

MFG _____ MODEL NO. _____

SERIAL NO. _____

CONTRACT NO. _____

CONTRACTOR NAME _____

CONTRACTOR ADDRESS _____

CONTRACTOR PHONE NO. _____

DATE WARRANTY EXPIRES _____

IN CASE OF WARRANTY ACTION FIRST CONTACT

(Point of contact, including name and telephone number.)

SERIAL NO. _____

CONTRACT NO. _____

DATE EQUIPMENT PLACED IN SERVICE _____

In the case of equipment repaired or replaced by the Contractor during the warranty period, the Equipment Warranty tag shall be replaced or updated, as applicable, to indicate the scope of the repair/replacement and the new warranty expiration date in accordance with paragraph WARRANTY OF CONSTRUCTION.

3.2.3 Equipment Identification Nameplates

In addition to the warranty identification tags noted above, all major items of equipment shall be permanently marked with an identification name to identify the equipment by type or function and specific unit number as indicated in the drawings, schedules, submittal data, or as directed. Designation of items such as motors shall coincide with their designation in the motor control panel. Items such as pumps and air handlers shall coincide with their respective controller or disconnect. Unless otherwise specified, identification nameplates shall be made of laminated plastic in accordance with ASTM D 709 with black (red for fire protection related equipment items) outer layers and a white core. Edges should be chamfered. Plates shall be fastened with round-head drive screws or with an approved adhesive. In cases where a nameplate is to be installed on an irregular object the nameplate shall be attached using a corrosion resistant metallic chain looped around the object or an appurtenance through a hole drilled in the nameplate. Additionally, each access door or access panel shall be provided with matching Identification Nameplate providing the same information so that the equipment behind the access door can be identified without opening the access door. Similarly, and in addition to the Equipment Identification Nameplate located on the equipment item, for equipment located above suspended ceilings an additional nameplate of similar type shall be applied to the suspended ceiling grid or at the wall near the wall angle providing matching information so that the equipment above ceiling can be located without removing ceiling panels.

The list below is not intended to be all-inclusive; the contractor should assume additional nameplates will be required. As a minimum all significant items of equipment shall be provided with an Equipment Identification Nameplate. Items shall include, but not be limited to the following items:

Liquid Chiller Units	Air Handlers
Water Tanks	Meters
Glycol Tanks	Major Water Treatment
	System Items
Pumps	Main Gas Shut Off Valve
Major Valves	Water Heaters
Boilers	Humidifiers
Condensate Pumps	Steam Converter
Make Up Air Units	Condensers
VAV Units	Fan Coil Units
Unit Heaters	
Electrical Panel Boards and sub-panels	Control Power Transformers
All Electrical Disconnects & Voltage	Control Devices
Starters	Instrument Transformers
Safety Switches	Switchboards
Transformers	Switchgear
Motor Control Centers	Motors
Equipment Enclosures	Time Clocks
Communication Panels & Enclosures	Major Communication
	Equipment Items

DDC Control Panels and Sub-panels
Control Equipment

Motor Operated Dampers

Kitchen Equipment Items
Food Service Equipment
Refrigeration and Freezing Equipment

Fire protection equipment
Fire Protection Panels

A schedule of items of equipment to receive Equipment Identification Nameplate including exact wording intended for each nameplate shall be prepared by the contractor and submitted to the Government for approval prior to the Pre-Warranty Conference described above. The items to receive Equipment Identification Nameplates shall be as noted above and as required by the COR. All Equipment Identification Nameplates must be in place prior to the Pre-Final Inspection and/or Final Inspection.

-- End of Section --

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SECTION 01704

FORM 1354 CHECKLIST

PART 1 GENERAL

1.1 Procedures

The form which is a part of this specification section shall be completed for any project having revisions to real property. The following page contains the basic instructions applicable to the form.

1.2 Submittal

Submit the following in accordance with Section 01330, "Submittal Procedures:"

SD-11 Closeout Submittals; G

[Form 1354 shall be submitted for approval, and be approved a minimum of 30 days before final inspection of the project. Failure to have this form completed and approved in time for the final inspection will result in delay of the inspection until the checklist is completed.]

[Form 1354 shall be submitted initially at the completion of design (see Section 00810, paragraph **** Draft Form 1354 Checklist). The Contractor shall update applicable portions of the form as various parts of the construction are completed and submit them to the Contracting Officer for approval. Final approval for the Form 1354 Checklist shall be obtained a minimum of 30 days before final inspection of the project. Failure to have this form completed and approved in time for the final inspection will result in delay of the inspection until the checklist is completed.]

PART 2 NOT USED

PART 3 NOT USED

INSTRUCTIONS FOR DD FORM 1354 CHECKLIST

The following checklist is only a guide to describe various parts of new and modified construction. Alter this form as necessary or create your own document to give complete accounting of the real property added or deleted for this contract. All items added, deleted, replaced, or relocated within the building 5 foot line, or on site 5 feet beyond the building perimeter must be accounted for completely. Only a few of the most common items beyond the 5 foot line are included on the checklist under UTILITIES/SURFACE CONSTRUCTION, add additional items as required by the construction accomplished.. Attach a continuation sheet and use the checklist format to describe other work related to this particular project. Listed on the last page are additional items with units of measure and descriptive terms.

Costs for each item must include material, tax, installation, overhead and profit, bond and insurance costs. This form should be filled out as each item is installed or each phase of work is completed.

TOTAL FOR ALL ITEMS INCLUDING CONTRACT MODIFICATION COSTS ADDED TOGETHER SHOULD EQUAL THE TOTAL CONTRACT PRICE.

NOTE: USE ENGLISH UNITS OF MEASURE, even if project is designed in metric units.

KEY TO ABBREVIATIONS

AC	Acres
BL	Barrels, Capacity
BTU	British Thermal Unit
CY	Cubic Yards
EA	Each
GA	Gallons, Capacity
HD	Head
kV	Kilovolt-Amperes, Capacity (kVA)
kW	Kilowatts, Capacity
SE	Seats
SF	Square Feet
SY	Square Yard
MB	Million British Thermal Units
MI	Miles
LF	Linear Feet
KG	Thousand Gallons Per Day, Capacity
TN	Ton
#	- Number; How Many

DD FORM 1354 CHECKLIST
Transfer of Real Property

CONTRACT NUMBER:_____

CONTRACT TITLE:_____

LOCATION:_____

1. DEMOLITION (Describe each item removed and the cost of removal.)*

2. RELOCATION (Describe each item relocated and the cost of relocation.)*

3. REPLACEMENTS (Describe each item replaced and replacement cost.)*

*Use a continuation sheet if more space is required. Items should be described by quantity and the correct unit of measure.

4. NEW CONSTRUCTION OVERVIEW: BUILDING(S)/ADDITION(S) TO A BUILDING - Use a separate checklist for each building and/or addition.

(1) Outside Dimensions: Length x Width

- (a) Main Building_____
- (b) Offsets_____
- (c) Wings_____
- (d) Basement_____

(e) Attic_____

(2) Number of Usable Floors: _____

(3) Construction: Exterior Materials Used

(a) Foundation (such as concrete)_____

(b) Floors (such as wood, concrete)_____

(c) Walls (such as wood siding, metal, CMU)_____

(d) Roof (such as metal, comp., built-up)_____

(4) Utilities ENTERING Building: Measure lineal feet from building entry
to next larger
size of pipe

(a) Water (size & type of pipe; number of lineal feet)_____

(b) Gas (size & type of pipe; number of lineal feet)_____

(c) Sewer (size & type of pipe; number of lineal feet)_____

(d) Electric (phase, voltage, size & type of wire, connected load
in amps)_____

(5) Air Conditioning:

(a) Type_____

(b) Capacity Kilograms (TONS)_____

(c) SQ YARDS covered by system_____

(6) Heating:

(a) Source_____

(b) Fuel_____

(7) Hot Water Facilities:

(a) Capacity Liters (GAL)_____

(b) Temperature Rise_____

BUILDING COST:_____

5. BUILDING SYSTEMS (INTERIOR)

A. FIRE PROTECTION:

Property Code

(1) (880 50/880-211) CLOSED HEAD AUTO SPRINKLERS - Square Feet & HD (wet or
dry pipe; # of Lineal Feet of service pipe; type of pipe & # of heads; # of
Square Feet covered by system)

DESCRIPTION:

COST: _____

(2) (880 50/880-212) OPEN HEAD DELUGE SYSTEM - Square Feet & HD (# of Lineal Feet of service pipe; type of pipe; # of heads; # of Square Feet covered)
DESCRIPTION:

COST: _____

(3) (880 10/880-221) AUTO FIRE DETECTION SYSTEM - Square Feet & EA (# of alarms-horns, bells, etc.; # of smoke detectors; # of heat detectors; # of fire alarm panels;
of radio transmitters/antennae)
DESCRIPTION:

COST: _____

(4) (880 20/880-222) MANUAL FIRE ALARM SYSTEM - EA (# of pull stations; # of alarm horns; # of fire extinguisher cabinets)
DESCRIPTION:

COST: _____

(5) (880 60/880-231) CO2 FIRE SYSTEM (# of bottles & size of bottles in kilograms (lbs.))
DESCRIPTION:

COST: _____

(6) (880 60/880-232) FOAM FIRE SYSTEM - EA (# of tanks - capacity in kilograms (lbs.))
DESCRIPTION:

COST: _____

(7) (880 60/880-233) OTHER FIRE SYSTEM - EA
DESCRIPTION:

COST: _____

(8) (880 60/880-234) HALON 1301 FIRE SYSTEM - EA (# of bottles & size of bottles in kilograms (lbs.))

DESCRIPTION:

COST: _____

B. SECURITY:

(1) (880 40/872-841) SECURITY ALARM SYSTEM - EA (name of system installed)

DESCRIPTION:

COST: _____

C. HEATING/COOLING SYSTEMS

(1) (826 10/890-126) A/C WINDOW UNITS - kilograms (TN) & Square Feet-(# of units installed; amount of Square Feet covered per unit; size & capacity of each unit)

DESCRIPTION:

COST: _____

(2) (826 14/890-125) A/C PLT LESS THAN 4,536 kilograms (5 TN) kilograms (TN) & square feet-(# of kilograms (TN); # of square feet covered)

DESCRIPTION:

COST: _____

(3) (826 13/890-121) A/C PLT 4,536 to 22,680 kilograms (5 TO 25 TN) kilograms (TN)-(# of kilograms (TN); # of square feet covered)

DESCRIPTION:

COST: _____

(4) (826 12/826-122) A/C PLT 22,680 to 2,267,962 kilograms (25 TO 100 TN) - kilograms (TN)-(# of kilograms (TN); # of square feet covered)

DESCRIPTION:

COST: _____

(5) (826 11/826-123) A/C PLT OVER 2,267,962 kilograms (100 TN) kilograms
(TN)-(# of kilograms (TN); # of square feet covered)

DESCRIPTION:

COST: _____

(6) (821 33/821-115) HEATING PLT 220/1026 W (750/3500 MB) - W (MB)-(# of kW
(MBH); type of heating system Ex: Warm air furnace, central)

DESCRIPTION:

COST: _____

(7) (821 32/821-116) HEATING PLT OVER 1026 W (3500 MB) - W(MB)-(# of kW
(MBH); type of heating system)

DESCRIPTION:

COST: _____

(8) (811 60/811-147) ELEC EMERGENCY POWER GENERATOR-KW-(size of engine;
rating of generator in kilowatts & voltage)

DESCRIPTION:

COST: _____

(9) (81190 or 82320-gas) STORAGE TANK FOR HEATING or GENERATOR FUEL Liters
(GA); TYPE; FUEL (Size, type of tank, kind of fuel & # of liters (gallons))

DESCRIPTION:

COST: _____

(10) (89220/890-272) EMCS - EA (Direct Digital Control Sys)

COST: _____

SITE WORK

6. UTILITIES/SURFACE CONSTRUCTION:

(1) (812 41/812-223) PRIM DISTR LINE OH Lineal Feet (# Lineal Feet of wire;
size & type of wire; # of poles; voltage)

DESCRIPTION:

COST: _____

(2) (812/81360) TRANSFORMERS KVA

POWER POLES Lineal Feet

(# poles; # transformers - pad or pole mounted; kVA of wire; # Lineal Feet of wire)

DESCRIPTION:

COST: _____

(3) (812 40/812-224) SEC DISTR LINE OH Lineal Feet (voltage; size & type of wire;

transformers; kVA; # Lineal Feet of wire; # of service drops; # poles)

DESCRIPTION:

COST: _____

(4) (812 42/812-225) PRIM DISTR LINE UG Lineal Feet (kVA; voltage; type of conduit &

size(encased or direct burial); size & kind of wire inside conduit; Lineal Feet of wire & conduit)

DESCRIPTION:

COST: _____

(5) (812 42/812-226) SEC DISTR LINE UG Lineal Feet (type of conduit & size; type & size

of wires in conduit; Lineal Feet of conduit & wire inside conduit; voltage)

DESCRIPTION:

COST: _____

(6) (812 30/812-926) EXTERIOR LIGHTING EA (streets or parking area lights) (#

& type of lights; whether pole mounted or not; # Lineal Feet of connecting wire if pole mounted)

DESCRIPTION:

COST: _____

(7) (824 10/824-464) GAS MAINS Lineal Feet (size, type, & # of Lineal Feet of pipe)

DESCRIPTION:

COST: _____

(8) (831 90/831-169) SEWAGE SEPTIC TANK thousand liters (KG) (size, kind of material, & capacity)

DESCRIPTION:

COST: _____

(9) (832 10/832-266) SANITARY SEWER Lineal Feet (sizes & types of pipes # of Lineal Feet of each; # of cleanouts; # & size of manholes)

DESCRIPTION:

COST: _____

(10) (842 10/842-245) WATER DISTR MAINS (POTABLE) Lineal Feet (# Lineal Feet & size, type of pipe)

DESCRIPTION:

COST: _____

(11) (843 11/843-315) FIRE HYDRANTS EA-(#; size & type)

DESCRIPTION:

COST: _____

(12) (851 90/851-143) CURBS & GUTTERS Lineal Feet (# Lineal Feet; material; width & height)

DESCRIPTION: (Is curb extruded or standard)_

COST: _____

(13) (851 90/851-145) DRIVEWAY Square Yards Square Yards; material used; thickness)

DESCRIPTION:

COST: _____

(14) (851 10/12/851-147) ROAD Square Yards & Lineal Feet Square Yards;
material used; thickness; Lineal Feet)
DESCRIPTION:

COST: _____

(15) (85210/11 /852-262) VEHICLE PARKING Square Yards-Square Yards; material
used; thickness; # of bollards; # of wheel stops; # of regular parking
spaces; # of handicap spaces)
DESCRIPTION:

COST: _____

(16) (852 20/852-289) SIDEWALKS Square Yards & Lineal Feet (# Square Feet &
Lineal Feet; dimensions of each section & location; thickness; material used)
DESCRIPTION:

COST: _____

(17) (871 10/871-183) STORM DRAIN DISPOSAL Lineal Feet (# Lineal Feet of
pipe; sizes & types of pipe; # of catch basins & manholes & sizes of each)
DESCRIPTION:

COST: _____

(18) (872 15/872-247) FENCE, SECURITY (ARMS) Lineal Feet (# of Lineal Feet;
fence material; # & type of gate(s); # strands of barbed wire on top)
DESCRIPTION:

COST: _____

(19) (87210/12/872-248) FENCE, INTERIOR Lineal Feet (# of Lineal Feet; fence
material; # & kind of gate(s)
DESCRIPTION:

COST: _____

(20) (890 70/890-187) UTILITY VAULT(4 or more transformers) Square Feet (# Square Feet; dimensions of vault; # of transformers)

DESCRIPTION:

COST: _____

(21) (135 10/135-583) TEL DUCT FACILITY Lineal Feet (# of Lineal Feet; size & type of conduit; type of wire)

DESCRIPTION:

COST: _____

(22) (135 10/135-586) TEL POLE FACILITY Lineal Feet (# Lineal Feet & type of wire; # of poles)

DESCRIPTION:

COST: _____

7. INSTALLED EQUIPMENT: Furnish an Equipment In Place List. Any price related to equipment should already be included in this checklist.

8. SYSTEMS NOT PREVIOUSLY LISTED: Attach a separate sheet and use the same format to describe the system(s). Example: CATV system, intercom system, or other utilities and surface construction not described on this checklist.

9. ASBESTOS REMOVAL: Furnish a description by building of the number of Lineal Feet of asbestos removed, number of Lineal Feet of reinsulation, number of Square Feet of soil encapsulation, and number and size of tanks, etc., where asbestos was removed. Also, identify buildings by their numbers and use.

10. MAINTENANCE/RENOVATIONS: List by building number and describe all additions and deletions by quantity and the correct unit of measure. Furnish a cost per building.

UTILITIES/SURFACE CONSTRUCTION Listed below are some additional items which may or may not apply to your contract. EACH item installed on site should be listed and priced separately even if not included on this checklist.

- (1) IRRIGATION SYSTEM(Lineal Feet of pipe; size & type of pipe; number and type of heads)
- (2) UNDERGROUND/ABOVEGROUND STORAGE TANKS(Liters (GA), type of tank; material stored)
- (3) (833-354) DUMPSTER ENCLOSURE(Square Feet & dimensions)
- (4) (890-152) UNLOADING PAD(Square Yards; material)
- (5) SIGNAGE(Dimensions; material)
- (6) (12580) CATHODIC PROTECTION(miles; Lineal Feet)
- (7) (87270) LIGHTNING PROTECTION Lineal Feet (LF)
- (8) (81290) POLE DUCT RISER(Lineal Feet (LF, type of material)
- (9) RAMPS Square Feet, material; Cubic Yards if concrete use code for sidewalk if concrete)
- (10) (89080/890-158) LOAD AND UNLOAD PLATFORM Square Feet
- (11) (83240/832-255) INDUSTRIAL WASTE MAIN Lineal Feet
- (12) WHEEL STOPS (EA; size & material)
- (13) (81350) OUTDOOR INTEGRAL DISTR CTR (kVA)
- (14) (45110) OUTDOOR STORAGE AREA Square Feet
- (15) (73055/730-275) BUS/WAIT SHELTER Square Feet
- (16) (690-432) FLAGPOLE (EA; dimensions)
- (17) (93210) SITE IMPROVEMENT (JOB)
- (18) (93220) LANDSCAPE PLANTING (Hectare (Acre); EA; Square Feet)
- (19) (93230) LANDSCAPE BERMS/MOUNDS Square Yards
- (20) (93410) CUT AND FILL Cubic Yards
- (21) (843-315) FIRE HYDRANTS (EA; Type)
- (22) (14970) LOADING AND UNLOADING DOCKS AND RAMPS (not connected to a building) Square Feet (23) BICYCLE RACK (EA)
- (24) (85140/812-928) TRAFFIC SIGNALS (EA)
- (25) (87210) FENCING OR WALLS Lineal Feet
- (26) (15432) RIPRAP Lineal Feet & Square Feet
- (27) (75061) GRANDSTAND OR BLEACHERS (EA; SE)
- (28) 87150/871-187) RETAINING WALLS Lineal Feet; Square Yards; material

NOTE: 5 Digit Codes Army; 6 Digit Codes Air Force
-- End of Section --

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SECTION 01705

INSTALLED BUILDING EQUIPMENT (REAL PROPERTY)
AND EQUIPMENT-IN-PLACE LIST (PERSONAL PROPERTY)

PART 1 GENERAL

1.1 SUBMITTALS

Data listed in PART 3 of this section shall be submitted in accordance with section 01330 SUBMITTAL PROCEDURES. Due dates shall be as indicated in applicable paragraphs and all submittals shall be completed before final payment will be made.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 Submittal

The final equipment lists shall be completed as two separate lists if both are required and returned to the Contracting Officer within 45 calendar days prior to the final inspection. The Contracting Officer will review all final equipment lists for accuracy and conformance to the requirements contained in DIVISION 1 GENERAL REQUIREMENTS. The lists shall be returned to the Contractor if corrections are necessary. The Contractor shall make all corrections and shall return the lists to the Contracting Officer within 7 calendar days of receipt.

3.2 INSTALLED BUILDING EQUIPMENT LIST

Contractor shall submit for approval, at the completion of construction, a list of installed building equipment. Installed building equipment (IBE) consists of items of equipment affixed and built into the facility as an integral part of the facility. It is equipment which supports the functionality of the building. This list shall be updated and kept current throughout construction, and shall be jointly inspected for accuracy and completeness by the Contracting Officer's representative and a responsible representative of the Contractor prior to submission of each monthly pay estimate. A sample form showing minimum data required is provided at the end of this section. The INSTALLED BUILDING EQUIPMENT LIST shall be comprised of all equipment falling under one or more of the following classifications:

- a. Each piece of equipment listed on the mechanical equipment schedules.
- b. Each electrical panel, switchboard, and MCC panel.
- c. Each transformer.
- d. Each piece of equipment that contains a manufacturer's serial number on the name plate.
- e. All Government furnished, Contractor installed equipment per a.

through d. (price data excluded)

Other examples of installed building equipment are listed on 1705-5.

3.3 EQUIPMENT-IN-PLACE LIST (EIP)

Contractor shall submit for approval, at completion of construction, a list of equipment-in-place. Equipment -in-place consists of capital equipment and other non-expendable supplies of personal property which are mission essential. Equipment-in-place is not real property and may be of a movable nature or affixed to real property, but removable without destroying or reducing the usefulness of the facility. This list shall be updated and kept current throughout construction, and shall be jointly inspected for accuracy and completeness by the Contracting Officer's representative and a responsible representative of the Contractor prior to submission of each monthly pay estimate if equipment-in-place is included in the construction contract. A sample form showing minimum data required is provided at the end of this section. See list on 01705-6 for items designated equipment-in-place.

INSTALLED BUILDING EQUIPMENT (IBE) (REAL PROPERTY)

CONTRACT NO.: _____

Specification Section: _____ Paragraph No. _____

ITEM DESCRIPTION: _____

Item Name: _____

Serial Number: _____

Model Number: _____

Capacity: _____ Replacement Cost _____

ITEM LOCATION:

Building Number: _____ Room Number: _____

or Column Location: _____

MANUFACTURER INFORMATION:

Manufacturer Name: _____

Trade Name (if different from item name):
_____Manufacturer's Address:

Telephone Number: _____

WARRANTY PERIOD: _____

CHECKED BY: _____

EQUIPMENT-IN-PLACE LIST (MISSION SUPPORT PERSONAL PROPERTY)

CONTRACT NO.: _____

Specification Section: _____ Paragraph No. _____

ITEM DESCRIPTION: _____

Item Name: _____

Serial Number: _____

Model Number: _____

Capacity: _____ Replacement Cost _____

ITEM LOCATION:

Building Number: _____ Room Number: _____

or Column Location: _____

MANUFACTURER INFORMATION:

Manufacturer Name: _____

Trade Name (if
different from item name):
_____Manufacturer's Address:

Telephone Number: _____

WARRANTY PERIOD: _____

CHECKED BY: _____

INSTALLED BUILDING EQUIPMENT

- | | |
|---|--|
| a. Antenna (master antennas for non-paid subscriber entertainment television systems | dd. Medical gas systems |
| b. Bedside headwall units conveyors | ee. Medical automated box |
| c. Bleachers (built-in) handling systems | ff. Medical material |
| d. Benches (built-in) | gg. Nurse call systems |
| e. Boilers | hh. Paging systems |
| f. Bookcases | ii. {Panel; boards |
| g. Cabinets (built-in) | jj. Plumbing |
| h. Carpet (wall to wall) | kk. Pneumatic tube systems |
| i. Chapel seating, baptisteries, altars, pulpits, communion rails and tables, etc. (built-in) | ll. Pot and pan washing equipment |
| j. Closets | mm. Protective construction features |
| k. Correctional facility equipment | nn. Refrigeration equipment (built-in) |
| l. Desks and tables (built-in) | oo. Storm sash and doors |
| m. Dishwasher equipment (built-in) | pp. Screens |
| n. Drinking water coolers (built-in) | qq. Shelving and racks (built-in) |
| o. Electrical components (built-in) | rr. Signage |
| p. Elevators and elevator doors | ss. Sprinklers |
| q. Escalators | tt. Sterilizers (built-in) |
| r. Exhaust systems | uu. Storage bins (built-in) |
| s. Fire Alarm and detection system | vv. Telecommunication systems |
| t. Food service equipment (built-in) | ww. Theater & auditorium railings |
| u. Gas fittings | xx. Theater stage & fire curtain |
| v. Hardware and fixtures for handicapped access | yy. Traffic railings |
| w. Heating, ventilating, and air conditioning and control systems | zz. Utility monitoring & control systems |
| x. Hoists (crane and crane rails) | aaa. Vaults |
| y. Incinerators | bbb. Wardrobes |
| z. Key control systems | ccc. Wardrobes |
| aa. Laboratory sinks, tables, and benches (built-in) | ddd. Waste disposers |
| bb. Lockers (built-in) | |
| cc. Meat cutting equipment | |

EQUIPMENT-IN-PLACE

PERSONAL PROPERTY (FIXED):

- a. Air raid alarm system
- b. Bleachers (portable)
- c. Closed circuit television system
- d. Conveyor systems
- e. Electronic repair laboratory & shop equip
- f. Electronic security equipment
- g. Fixed navigational aids
- h. Fixed target range system
- i. Intrusion alarm system
- j. Laundry equipment
- k. Lightning protection system
- l. Medical and dental equipment
- m. Organs
- l. Wall clocks
- n. Paint sprayers
- o. Photographic equipment
- p. Printing presses/related equipment
- q. Scientific measuring instruments
- r. Steam cleaning equipment
- s. Telescopes
- t. Testing equipment
- u. Training equipment and simulators
- v. Vats
- w. Wash tanks
- x. Watch reporting system
- y. Welding machines
- z. Woodworking equipment

PERSONAL PROPERTY (MOVABLE):

- a. Automated data processing equipment
- b. Dental chairs and pedestal units
- c. Filing cabinets and portable safes
- d. Food service equipment (portable)
- e. Furnishings, including rugs
- f. Furniture (chairs, tables, beds, desks, and partitions)
- g. Office machines
- h. Photographic equipment (portable)
- i. Pre-wired workstations
- j. Shop equipment
- k. Training aids/equip, including simulators

-- End of Section --

SECTION 02220

DEMOLITION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR-CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI Guideline K (1997) Containers for Recovered
Fluorocarbon Refrigerants

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.6 (1990; R 1998) Safety Requirements for
Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE EM 385-1-1 (2003) Safety -- Safety and Health
Requirements

U.S. DEFENSE LOGISTICS AGENCY (DLA)

DLA 4145.25 (June 2000) Storage and Handling of
Liquefied and Gaseous Compressed Gases and
Their Full and Empty Cylinders

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 4000.25-1-M (2000) Requisitioning and Issue Procedures

MIL-STD-129 (Rev P) Military Marking for Shipment and
Storage

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 61-SUBPART M National Emission Standard for Asbestos

40 CFR 82 Protection of Stratospheric Ozone

49 CFR 173.301 Shipment of Compressed Gases in Cylinders
and Spherical Pressure Vessels

1.2 GENERAL REQUIREMENTS

Do not begin demolition until authorization is received from the

Contracting Officer. Remove rubbish and debris from the project site; do not allow accumulations. The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with COE EM 385-1-1, Section 23, Demolition, and other applicable Sections.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Certificates

Demolition plan; G.
Notifications; G.

SD-11 Closeout Submittals

Receipts

Receipts or bills of lading, as specified.

1.4 REGULATORY AND SAFETY REQUIREMENTS

Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ANSI A10.6.

1.4.1 Notifications

1.4.1.1 General Requirements

Furnish timely notification of demolition projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61-SUBPART M. Notify the State's environmental protection agency, local air pollution control district/agency and the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61-SUBPART M.

1.5 DUST AND DEBRIS CONTROL

Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution. Sweep pavements as often as necessary to control the spread of debris.

1.6 PROTECTION

1.6.1 Traffic Control Signs

Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Anchor barricades in a manner to prevent displacement by wind. Notify the Contracting Officer prior to beginning such work.

1.6.2 Existing Work

Before beginning any demolition work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing work in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized 4 inch will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, the location and extent of cracks and other damage and description of surface conditions that exist prior to before starting work.

1.6.3 Items to Remain in Place

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Contracting Officer. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

1.6.4 Trees

Protect trees within the project site which might be damaged during demolition, and which are indicated to be left in place, by a 6 foot high fence. Erect and secure fence a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Replace any tree designated to remain that is damaged during the work under this contract with like-kind or as approved by the Contracting Officer.

1.6.5 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition operations. Prior to start of work, utilities serving each area of alteration or removal will be shut off by the Government and disconnected and sealed by the Contractor.

1.6.6 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result

of any cutting, removal, or demolition work performed under this contract.

1.7 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.8 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Items to be relocated which are damaged by the Contractor shall be repaired or replaced with new undamaged items as approved by the Contracting Officer.

1.9 ENVIRONMENTAL PROTECTION

Comply with the Environmental Protection Agency requirements specified.

1.10 USE OF EXPLOSIVES

Use of explosives will not be permitted.

PART 2 PRODUCTS

2.1 FILL MATERIAL

Comply with excavating, backfilling, and compacting procedures for soils used as backfill material to fill basements, voids, depressions or excavations resulting from demolition of structures.

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

3.1.1 Utilities and Related Equipment

3.1.1.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

3.1.1.2 Disconnecting Existing Utilities

Remove existing utilities, as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered that are not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area. Remove meters and related equipment and deliver to a location in accordance with instructions

of the Contracting Officer.

3.1.2 Chain Link Fencing

Remove chain link fencing, gates and other related salvaged items scheduled for removal and transport to designated areas. Remove gates as whole units. Cut chain link fabric to 25 foot lengths and store in rolls off the ground.

3.1.3 Paving and Slabs

Remove concrete and asphaltic concrete paving and slabs including aggregate base to a depth of 8 inches below new finish grade. Provide neat sawcuts at limits of pavement removal as indicated.

3.1.4 Piping

Disconnect piping at unions, flanges and valves, and fittings as required to reduce the pipe into straight lengths for practical storage. Store salvaged piping according to size and type. If the piping that remains can become pressurized due to upstream valve failure, end caps, blind flanges, or other types of plugs or fittings with a pressure gage and bleed valve shall be attached to the open end of the pipe to ensure positive leak control. Carefully dismantle piping that previously contained gas, gasoline, oil, or other dangerous fluids, with precautions taken to prevent injury to persons and property. Store piping outdoors until all fumes and residues are removed. Box prefabricated supports, hangers, plates, valves, and specialty items according to size and type. Wrap sprinkler heads individually in plastic bags before boxing. Classify piping not designated for salvage, or not reusable, as scrap metal.

3.1.5 Electrical Devices

Remove and salvage switches, switchgear, transformers, conductors including wire and nonmetallic sheathed and flexible armored cable, regulators, meters, instruments, plates, circuit breakers, panelboards, outlet boxes, and similar items. Box and tag these items for identification according to type and size.

3.1.5.1 Conduit and Miscellaneous Items

Salvage conduit except where embedded in concrete or masonry. Consider corroded, bent, or damaged conduit as scrap metal. Sort straight and undamaged lengths of conduit according to size and type. Classify supports, knobs, tubes, cleats, and straps as debris to be removed and disposed.

3.2 CONCURRENT EARTH-MOVING OPERATIONS

Do not begin excavation, filling, and other earth-moving operations that are sequential to demolition work in areas occupied by structures to be demolished until all demolition in the area has been completed and debris removed. Holes, open basements and other hazardous openings shall be filled.

3.3 DISPOSITION OF MATERIAL

3.3.1 Title to Materials

Except for salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition and removal procedures, and authorization by the Contracting Officer to begin demolition. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award.

Materials and equipment shall not be viewed by prospective purchasers or sold on the site.

3.3.2 Reuse of Materials and Equipment

Remove and store materials and equipment indicated to be reused or relocated to prevent damage, and reinstall as the work progresses.

3.3.3 Disposal of Ozone Depleting Substance (ODS)

Class I and Class II ODS are defined in Section, 602(a) and (b), of The Clean Air Act. Prevent discharge of Class I and Class II ODS to the atmosphere. Place recovered ODS in cylinders meeting ARI Guideline K suitable for the type ODS (filled to no more than 80 percent capacity) and provide appropriate labeling. Recovered ODS shall be turned over to the Contracting Officer. Products, equipment and appliances containing ODS in a sealed, self-contained system (e.g. residential refrigerators and window air conditioners) shall be disposed of in accordance with 40 CFR 82.

3.3.3.1 Special Instructions

No more than one type of ODS is permitted in each container. A warning/hazardous label shall be applied to the containers in accordance with Department of Transportation regulations. All cylinders including but not limited to fire extinguishers, spheres, or canisters containing an ODS shall have a tag with the following information:

- a. Activity name and unit identification code
- b. Activity point of contact and phone number
- c. Type of ODS and pounds of ODS contained
- d. Date of shipment

3.3.4 Transportation Guidance

Shipment of all ODS containers shall be in accordance with MIL-STD-129, DLA 4145.25 (also referenced one of the following: Air Force Regulation 67-12), 49 CFR 173.301, and DOD 4000.25-1-M.

3.3.5 Unsalvageable Material

Concrete, masonry, and other noncombustible material, except concrete permitted to remain in place, shall be disposed of in a disposal area. Dispose of combustible material in the sanitary fill area located off the site.

3.4 CLEANUP

Debris and rubbish shall be removed from basement and similar excavations. Debris shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

3.5 DISPOSAL OF REMOVED MATERIALS

3.5.1 Sub Title

Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations with all applicable federal, state and local regulations as contractually specified. Removed materials shall not be stored on the project site.

3.6 REUSE OF SALVAGED ITEMS

Recondition salvaged materials and equipment designated for reuse before installation. Replace items damaged during removal and salvage operations or restore them as necessary to usable condition.

-- End of Section --

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SECTION 02231

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Nonsaleable Materials; G.

Written permission to dispose of such products on private property shall be filed with the Contracting Officer.

SD-04 Samples

Tree wound paint

Herbicide

Submit samples in cans with manufacturer's label.

1.2 DELIVERY, STORAGE, AND HANDLING

Deliver materials to, store at the site, and handle in a manner which will maintain the materials in their original manufactured or fabricated condition until ready for use.

PART 2 PRODUCTS

2.1 TREE WOUND PAINT

Bituminous based paint of standard manufacture specially formulated for tree wounds.

2.2 HERBICIDE

Comply with Federal Insecticide, Fungicide, and Rodenticide Act (Title 7 U.S.C. Section 136) for requirements on contractor's licensing, certification and record keeping. Contact the command Pest Control Coordinator prior to starting work.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.2 Trees, Shrubs, and Existing Facilities

Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require.

3.1.3 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer immediately of damage to or an encounter with an unknown existing utility line. The Contractor shall be responsible for the repairs of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, the Contractor shall notify the Contracting Officer in ample time to minimize interruption of the service.

3.2 CLEARING

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within the areas to be cleared. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter and shall be trimmed of all branches the heights indicated or directed. Limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branches. Cuts more than 1-1/2 inches in diameter shall be painted with an approved tree-wound paint. Apply herbicide in accordance with the manufacturer's label to the top surface of stumps designated not to be removed.

3.3 TREE REMOVAL

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Trees shall be disposed of as specified in paragraph DISPOSAL OF MATERIALS.

3.4 PRUNING

Trim trees designated to be left standing within the cleared areas of dead branches 1 1/2 inches or more in diameter; and trim branches to heights and in a manner as indicated. Neatly cut limbs and branches to be trimmed close to the bole of the tree or main branches. Paint cuts more than 1 1/4

inches in diameter with an approved tree wound paint.

3.5 GRUBBING

Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas. Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground.

3.6 DISPOSAL OF MATERIALS

3.6.1 Nonsaleable Materials

Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, shall be disposed of outside the limits of Government-controlled land at the Contractor's responsibility, except when otherwise directed in writing. Such directive will state the conditions covering the disposal of such products and will also state the areas in which they may be placed.

-- End of Section --

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SECTION 02300

EARTHWORK

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO T 180 (2001) Moisture-Density Relations of Soils
Using a 4.54-kg (10-lb) Rammer and an
457-mm (18-in) Drop

AASHTO T 224 (2001) Correction for Coarse Particles in
the Soil Compaction Test

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA C600 (1999) Installation of Ductile-Iron Water
Mains and Their Appurtenances

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2002) Structural Welding Code - Steel

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C2 (2001) Lumber, Timber, Bridge Ties and
Mine Ties - Preservative Treatment by
Pressure Processes

AWPA P5 (2002) Standard for Waterborne
Preservatives

ASTM INTERNATIONAL (ASTM)

ASTM A 139 (2000) Electric-Fusion (Arc)-Welded Steel
Pipe (NPS 4 and Over)

ASTM A 252 (1998; R 2002) Welded and Seamless Steel
Pipe Piles

ASTM C 136 (2001) Sieve Analysis of Fine and Coarse
Aggregates

ASTM C 33 (2003) Concrete Aggregates

ASTM D 1140	(2000) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2002) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2167	(1994; R 2001) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2434	(1968; R 2000) Permeability of Granular Soils (Constant Head)
ASTM D 2487	(2000) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(2001) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2937	(2000e1) Density of Soil in Place by the Drive-Cylinder Method
ASTM D 422	(1963; R 2002) Particle-Size Analysis of Soils
ASTM D 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 698	(2000a) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SW-846.3-3a	(1999) Test Methods for Evaluating Solid Waste: Physical/Chemical Methods; Third Edition; Final Update III-A
EPA 600/4-79/020	(1983) Methods for Chemical Analysis of Water and Wastes

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-203	(Rev C; Notice 2) Paper, Kraft, Untreated
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1.2 DEFINITIONS

1.2.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW and SP.

Satisfactory materials for grading shall be comprised of stones less than 8 inches, except for fill material for pavements and railroads which shall be comprised of stones less than 3 inches in any dimension.

1.2.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. The Contracting Officer shall be notified of any contaminated materials.

1.2.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Testing required for classifying materials shall be in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.

1.2.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated as a percent of laboratory maximum density. Since ASTM D 1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve shall be expressed as a percentage of the maximum density in accordance with AASHTO T 180 Method D and corrected with AASHTO T 224. To maintain the same percentage of coarse material, the "remove and replace" procedure as described in the NOTE 8 in Paragraph 7.2 of AASHTO T 180 shall be used.

1.2.5 Topsoil

Material suitable for topsoils obtained from excavations is defined as: Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.

1.2.6 Hard/Unyielding Materials

Weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" with stones greater than 10 inches in any dimension or as defined by the pipe manufacturer, whichever is smaller. These materials usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.2.7 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1/2 cubic yard in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.2.8 Unstable Material

Unstable material shall consist of materials too wet to properly support the utility pipe, conduit, or appurtenant structure.

1.2.9 Select Granular Material

1.2.9.1 General Requirements

Select granular material shall consist of materials classified as GW, GP, SW, SP, or by ASTM D 2487 where indicated. The liquid limit of such material shall not exceed 35 percent when tested in accordance with ASTM D 4318. The plasticity index shall not be greater than 12 percent when tested in accordance with ASTM D 4318, and not more than 35 percent by weight shall be finer than No. 200 sieve when tested in accordance with ASTM D 1140. Coefficient of permeability shall be a minimum of 0.002 feet per minute when tested in accordance with ASTM D 2434.

1.2.9.2 Gradation of Granular Select Material (Road Base)

The combined material shall conform to the following sieve analysis:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
2 1/2 inches	100
No. 4	40 - 85
No. 10	20 - 80
No. 40	10 - 60
No. 200	5 - 25

1.2.10 Initial Backfill Material

Initial backfill shall consist of select granular material or satisfactory materials free from rocks 3 inches or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, the initial backfill material shall be free of stones larger than 2 inches in any dimension or as recommended by the pipe manufacturer, whichever is smaller.

1.2.11 Expansive Soils

Expansive soils are defined as soils that have a plasticity index equal to or greater than 27 when tested in accordance with ASTM D 4318.

1.2.12 Nonfrost Susceptible (NFS) Material

Nonfrost susceptible material shall be a uniformly graded washed sand with a maximum particle size of 1-1/2 inch and less than 5 percent passing the No. 200 size sieve, and with not more than 3 percent by weight finer than 0.02 mm grain size.

1.2.13 Pile Supported Structure

As used herein, a structure where both the foundation and floor slab are pile supported.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

SD-03 Product Data

Utilization of Excavated Materials; G.
Rock Excavation
Opening of any Excavation or Borrow Pit
Shoulder Construction

Procedure and location for disposal of unused satisfactory material. Proposed source of borrow material. Notification of encountering rock in the project. Advance notice on the opening of excavation or borrow areas. Advance notice on shoulder construction for rigid pavements.

SD-06 Test Reports

Testing
Borrow Site Testing

Within 24 hours of conclusion of physical tests, 4 copies of test results, including calibration curves and results of calibration tests. Results of testing at the borrow site.

SD-07 Certificates

Testing

Qualifications of the commercial testing laboratory or Contractor's testing facilities.

1.4 SUBSURFACE DATA

Subsurface soil boring logs are appended to the SPECIAL CONTRACT REQUIREMENTS. The subsoil investigation report and samples of materials taken from subsurface investigations may be examined. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.5 CLASSIFICATION OF EXCAVATION

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.5.1 Common Excavation

Common excavation shall include the satisfactory removal and disposal of all materials not classified as rock excavation.

1.5.2 Rock Excavation

Rock excavation shall include blasting, excavating, grading, and disposing of material classified as rock and shall include the satisfactory removal and disposal of boulders 1/2 cubic yard or more in volume; solid rock; rock material that is in ledges, bedded deposits, and unstratified masses, which cannot be removed without systematic drilling and blasting; firmly cemented conglomerate deposits possessing the characteristics of solid rock impossible to remove without systematic drilling and blasting; and hard materials (see Definitions). The removal of any concrete or masonry structures, except pavements, exceeding 1/2 cubic yard in volume that may be encountered in the work shall be included in this classification. If at any time during excavation, including excavation from borrow areas, the Contractor encounters material that may be classified as rock excavation, such material shall be uncovered and the Contracting Officer notified by the Contractor. The Contractor shall not proceed with the excavation of this material until the Contracting Officer has classified the materials as common excavation or rock excavation and has taken cross sections as required. Failure on the part of the Contractor to uncover such material, notify the Contracting Officer, and allow ample time for classification and cross sectioning of the undisturbed surface of such material will cause the forfeiture of the Contractor's right of claim to any classification or volume of material to be paid for other than that allowed by the Contracting Officer for the areas of work in which such deposits occur.

1.6 CRITERIA FOR BIDDING

Base bids on the following criteria:

- a. Surface elevations are as indicated.
- b. Pipes or other artificial obstructions, except those indicated, will not be encountered.
- c. Material character is indicated by the boring logs.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR OFFSITE SOILS

Offsite soils brought in for use as backfill shall be tested for TPH, BTEX and full TCLP including ignitability, corrosivity and reactivity. Backfill shall contain less than 100 parts per million (ppm) of total petroleum hydrocarbons (TPH) and less than 10 ppm of the sum of Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and shall not fail the TCPL test. TPH concentrations shall be determined by using EPA 600/4-79/020 Method 418.1. BTEX concentrations shall be determined by using EPA SW-846.3-3a Method 5030/8020. TCLP shall be performed in accordance with EPA SW-846.3-3a Method 1311. Provide Borrow Site Testing for TPH, BTEX and TCLP from a composite sample of material from the borrow site, with at least one test from each borrow site. Material shall not be brought on site until tests have been approved by the Contracting Officer.

2.2 BURIED WARNING AND IDENTIFICATION TAPE

Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

Warning Tape Color Codes

Red:	Electric
Yellow:	Gas, Oil; Dangerous Materials
Orange:	Telephone and Other Communications
Blue:	Water Systems
Green:	Sewer Systems
White:	Steam Systems
Gray:	Compressed Air

2.2.1 Warning Tape for Metallic Piping

Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

2.2.2 Detectable Warning Tape for Non-Metallic Piping

Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape

is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.3 DETECTION WIRE FOR NON-METALLIC PIPING

Detection wire shall be insulated single strand, solid copper with a minimum of 12 AWG.

2.4 MATERIAL FOR RIP-RAP

2.4.1 Bedding Material

Consisting of sand, gravel, or crushed rock, well graded, or poorly graded with a maximum particle size of 2 inches. Material shall be composed of tough, durable particles. Fines passing the No. 200 standard sieve shall have a plasticity index less than six.

2.4.2 Grout

Composed of cement, water, an air-entraining admixture, and sand mixed in proportions of one part portland cement to two parts of sand, sufficient water to produce a workable mixture, and an amount of admixture which will entrain sufficient air to produce durable grout, as determined by the Contracting Officer. Mix grout in a concrete mixer. Mixing time shall be sufficient to produce a mixture having a consistency permitting gravity flow into the interstices of the rip-rap with limited spading and brooming.

2.5 CAPILLARY WATER BARRIER

Capillary Water Barrier shall consist of clean, poorly graded crushed rock, crushed gravel, or uncrushed gravel placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below. Fine aggregate grading shall conform to ASTM C 33 with a maximum of 3 percent by weight passing ASTM D 1140, No. 200 sieve, or 1-1/2 inches and no more than 2 percent by weight passing the No. 4 size sieve or coarse aggregate Size 57, 67, or 77.

2.6 PIPE CASING

2.6.1 Casing Pipe

ASTM A 139, Grade B, or ASTM A 252, Grade 2, smooth wall pipe. Casing size shall be of the outside diameter and wall thickness as indicated. Protective coating is not required on casing pipe.

2.6.2 Wood Supports

Treated Yellow Pine or Douglas Fir, rough, structural grade. Provide wood with nonleaching water-borne pressure preservative (ACA or CCA) and treatment conforming to AWPA P5 and AWPA C2, respectively. Secure wood supports to carrier pipe with stainless steel or zinc-coated steel bands.

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Where indicated or directed, topsoil shall be stripped to a depth of 4 inches. Topsoil shall be spread on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Topsoil shall be kept separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inches in diameter, and other materials that would interfere with planting and maintenance operations. Any surplus of topsoil from excavations and grading shall be removed from the site.

3.2 GENERAL EXCAVATION

The Contractor shall perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph FINISHING. Satisfactory excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Unsatisfactory materials encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials as directed. Such excavated material and the satisfactory material ordered as replacement shall be included in excavation. Surplus satisfactory excavated material not required for fill or embankment shall be disposed of in areas approved for surplus material storage or designated waste areas. Unsatisfactory excavated material shall be disposed of in designated waste or spoil areas.

During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be excavated from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

3.2.1 Drainage Structures

Excavations shall be made to the lines, grades, and elevations shown, or as directed. Trenches and foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock or other hard foundation material shall be cleaned of loose debris and cut to a firm, level, stepped, or serrated surface. Loose disintegrated rock and thin strata shall be removed. When concrete or masonry is to be placed in an excavated area, the bottom of the excavation shall not be disturbed. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed. Where pile foundations are to be used, the excavation of each pit shall be stopped at an elevation 1 foot above the base of the footing, as specified, before piles are driven. After the pile driving has been completed, loose and displaced material shall be removed and excavation completed, leaving a smooth, solid, undisturbed surface to receive the concrete or masonry.

3.2.2 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. The Contractor shall establish/construct storm drainage features (ponds) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.2.3 Trench Excavation Requirements

The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Trench walls below the top of the pipe shall be sloped, or made vertical, and of such width as recommended in the manufacturer's installation manual. Where no manufacturer's installation manual is available, trench walls shall be made vertical. Trench walls more than 4 feet high shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be exposed to moving ground or cave in. Vertical trench walls more than 4 feet high shall be shored. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil. Special attention shall be given to slopes which may be adversely affected by weather or moisture content. The trench width below the top of pipe shall not exceed 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter and shall not exceed 36 inches plus pipe outside diameter for sizes larger than 24 inches inside diameter. Where recommended trench widths are exceeded, redesign, stronger pipe, or special installation procedures shall be utilized by the Contractor. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to the Government.

3.2.3.1 Bottom Preparation

The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 3 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

3.2.3.2 Removal of Unyielding Material

Where overdepth is not indicated and unyielding material is encountered in the bottom of the trench, such material shall be removed 6 inches below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.2.3.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Government.

3.2.3.4 Excavation for Appurtenances

Excavation for manholes, catch-basins, inlets, or similar structures shall be sufficient to leave at least 12 inches clear between the outer structure surfaces and the face of the excavation or support members. Rock shall be cleaned of loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Loose disintegrated rock and thin strata shall be removed. Removal of unstable material shall be as specified above. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.2.3.5 Jacking, Boring, and Tunneling

Unless otherwise indicated, excavation shall be by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Contracting Officer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections.

3.2.4 Underground Utilities

Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Perform work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility company. Excavation made with power-driven equipment is not permitted within two feet of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

3.2.5 Structural Excavation

Ensure that footing subgrades have been inspected and approved by the Contracting Officer prior to concrete placement. Excavate to bottom of pile cap prior to placing or driving piles, unless authorized otherwise by the Contracting Officer. Backfill and compact over excavations and changes in grade due to pile driving operations to 95 percent of ASTM D 698 maximum density.

3.3 SELECTION OF BORROW MATERIAL

Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas within the limits of the project site, selected by the Contractor or from approved private sources. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.

3.4 OPENING AND DRAINAGE OF EXCAVATION AND BORROW PITS

The Contractor shall notify the Contracting Officer sufficiently in advance of the opening of any excavation or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, borrow pits and other excavation areas shall be excavated providing adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of as directed. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.5 SHORING

3.5.1 General Requirements

The Contractor shall submit a Shoring and Sheet piling plan for approval 15 days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheet piling of excavations. Shoring, including sheet piling, shall be furnished and installed as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Shoring, bracing, and sheet piling shall be removed as excavations are backfilled, in a manner to prevent caving.

3.5.2 Geotechnical Engineer

The Contractor is required to hire a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer shall be responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer shall update the excavation, sheet piling and dewatering plans as construction progresses to reflect changing conditions and shall submit an updated plan if necessary. A written report shall be submitted, at least monthly, informing the Contractor and Contracting Officer of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any

present or potential problems. The Geotechnical Engineer shall be available to meet with the Contracting Officer at any time throughout the contract duration.

3.6 GRADING AREAS

Where indicated, work will be divided into grading areas within which satisfactory excavated material shall be placed in embankments, fills, and required backfills. The Contractor shall not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed by rubber-tired equipment, excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such material shall be removed and replaced with satisfactory material from approved sources.

3.7 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Excavation to final grade shall not be made until just before concrete is to be placed. Only excavation methods that will leave the foundation rock in a solid and unshattered condition shall be used. Approximately level surfaces shall be roughened, and sloped surfaces shall be cut as indicated into rough steps or benches to provide a satisfactory bond. Shales shall be protected from slaking and all surfaces shall be protected from erosion resulting from ponding or flow of water.

3.8 GROUND SURFACE PREPARATION

3.8.1 General Requirements

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as directed by the Contracting Officer. The surface shall be scarified to a depth of 6 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 6 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill.

3.8.2 Frozen Material

Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to plus or minus 2 percent of optimum moisture to provide the moisture content that will readily facilitate obtaining the

specified compaction with the equipment used. Minimum subgrade density shall be as specified in paragraph TESTING.

3.9 UTILIZATION OF EXCAVATED MATERIALS

Unsatisfactory materials removed from excavations shall be disposed of in designated waste disposal or spoil areas. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed of in designated areas approved for surplus material storage or designated waste areas as directed. Newly designated waste areas on Government-controlled land shall be cleared and grubbed before disposal of waste material thereon. Coarse rock from excavations shall be stockpiled and used for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. No excavated material shall be disposed of to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.10 BURIED TAPE AND DETECTION WIRE

3.10.1 Buried Warning and Identification Tape

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

3.10.2 Buried Detection Wire

Bury detection wire directly above non-metallic piping at a distance not to exceed 12 inches above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 3 feet of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.

3.11 BACKFILLING AND COMPACTION

Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure. Ground surface on which backfill is to be placed shall be prepared as specified in paragraph PREPARATION OF GROUND SURFACE FOR EMBANKMENTS. Compaction requirements for backfill materials shall also conform to the applicable portions of paragraphs PREPARATION OF GROUND SURFACE FOR EMBANKMENTS, EMBANKMENTS, and SUBGRADE PREPARATION, and Section 02630 STORM DRAINAGE; and Section 02300 EARTHWORK. Compaction shall be

accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.11.1 Trench Backfill

Trenches shall be backfilled to the grade shown. The trench shall not be backfilled until all specified tests are performed.

3.11.1.1 Replacement of Unyielding Material

Unyielding material removed from the bottom of the trench shall be replaced with select granular material or initial backfill material.

3.11.1.2 Replacement of Unstable Material

Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 6 inches loose thickness.

3.11.1.3 Bedding and Initial Backfill

Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit.

The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D 698 maximum density.

Plastic piping shall have bedding to spring line of pipe. Provide materials as follows:

- a. Class I: Angular, 0.25 to 1.5 inches, graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.
- b. Class II: Coarse sands and gravels with maximum particle size of 1.5 inches, including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D 2487.

3.11.1.4 Final Backfill

The remainder of the trench, except for special materials for roadways, railroads and airfields, shall be filled with satisfactory material.

Backfill material shall be placed and compacted as follows:

- a. Roadways, Railroads, and Airfields: Backfill shall be placed up to the required elevation as specified. Water flooding or jetting methods of compaction will not be permitted.
- b. Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas: Backfill shall be deposited in layers of a maximum of 12 inch

loose thickness, and compacted to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. Compaction by water flooding or jetting will not be permitted. This requirement shall also apply to all other areas not specifically designated above.

3.11.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for 14 days, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be brought up evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.12 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.12.1 Gas Distribution

Trenches shall be excavated to a depth that will provide not less than 18 inches of cover in rock excavation and not less than 24 inches of cover in other excavation. Trenches shall be graded as specified for pipe-laying requirements in Section 02556A GAS DISTRIBUTION SYSTEM.

3.12.2 Water Lines

Trenches shall be of a depth to provide a minimum cover of 4 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe.

3.12.3 Heat Distribution System

Initial backfill material shall be free of stones larger than 1/4 inch in any dimension.

3.12.4 Electrical Distribution System

Direct burial cable and conduit or duct line shall have a minimum cover of 24 inches from the finished grade, unless otherwise indicated. Special trenching requirements for direct-burial electrical cables and conduits are specified in Section 16302N UNDERGROUND TRANSMISSION AND DISTRIBUTION.

3.12.5 Sewage Absorption Trenches or Pits

3.12.5.1 Porous Fill

Backfill material consisting of clean crushed rock or gravel having a gradation conforming to the requirements of gradation No. 4 for coarse aggregate in ASTM C 33.

3.12.5.2 Cover

Filter fabric, Kraft paper conforming to FS A-A-203, Grade B, No. 2, 50 pound weight as indicated.

3.12.6 Pipeline Casing

Provide new smooth wall steel pipeline casing under new and existing pavement in a trench and by the boring and jacking method of installation. Provide each new pipeline casing, where indicated and to the lengths and dimensions shown, complete and suitable for use with the new piped utility as indicated. Install pipeline casing by dry boring and jacking method as follows:

3.12.6.1 Bore Holes

Mechanically bore holes and case through the soil with a cutting head on a continuous auger mounted inside the casing pipe. Weld lengths of pipe together in accordance with AWS D1.1/D1.1M. Do not use water or other fluids in connection with the boring operation.

3.12.6.2 Cleaning

Clean inside of the pipeline casing of dirt, weld splatters, and other foreign matter which would interfere with insertion of the piped utilities by attaching a pipe cleaning plug to the boring rig and passing it through the pipe.

3.12.6.3 End Seals

After installation of piped utilities in pipeline casing, provide watertight end seals at each end of pipeline casing between pipeline casing and piping utilities. Provide watertight segmented elastomeric end seals.

3.12.7 Rip-Rap Construction

3.12.7.1 Bedding Placement

Spread bedding material uniformly to a thickness of at least 3 inches on prepared subgrade as indicated. Compaction of bedding is not required. Finish bedding to present even surface free from mounds and windrows.

3.13 EMBANKMENTS

3.13.1 Earth Embankments

Earth embankments shall be constructed from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 3 inches. The material shall be placed in successive horizontal layers of loose material not more than 8 inches in depth. Each layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, each layer shall be plowed, disked, or otherwise broken up; moistened or aerated as

necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction requirements for the upper portion of earth embankments forming subgrade for pavements shall be identical with those requirements specified in paragraph SUBGRADE PREPARATION. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.14 SUBGRADE PREPARATION

3.14.1 Construction

Subgrade shall be shaped to line, grade, and cross section, and compacted as specified. This operation shall include plowing, disking, and any moistening or aerating required to obtain specified compaction. Soft or otherwise unsatisfactory material shall be removed and replaced with satisfactory excavated material or other approved material as directed. Rock encountered in the cut section shall be excavated to a depth of 6 inches below finished grade for the subgrade. Low areas resulting from removal of unsatisfactory material or excavation of rock shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and compacted as specified. After rolling, the surface of the subgrade for roadways shall not show deviations greater than 2 inch when tested with a 20 foot straightedge applied both parallel and at right angles to the centerline of the area. The elevation of the finish subgrade shall not vary more than 0.05 foot from the established grade and cross section.

3.14.2 Compaction

Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas and railroads, each layer of the embankment shall be compacted to at least 95 percent of laboratory maximum density.

3.14.2.1 Subgrade for Railroads

Subgrade for railroads shall be compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials.

3.14.2.2 Subgrade for Pavements

Subgrade for pavements shall be compacted to at least 95 percentage laboratory maximum density for the depth below the surface of the pavement shown. When more than one soil classification is present in the subgrade, the top 6 inches of subgrade shall be scarified, windrowed, thoroughly blended, reshaped, and compacted.

3.14.2.3 Subgrade for Shoulders

Subgrade for shoulders shall be compacted to at least 95 percentage

laboratory maximum density for the full depth of the shoulder.

3.15 SHOULDER CONSTRUCTION

Shoulders shall be constructed of satisfactory excavated or borrow material or as otherwise shown or specified. Shoulders shall be constructed as soon as possible after adjacent paving is complete, but in the case of rigid pavements, shoulders shall not be constructed until permission of the Contracting Officer has been obtained. The entire shoulder area shall be compacted to at least the percentage of maximum density as specified in paragraph SUBGRADE PREPARATION above, for specific ranges of depth below the surface of the shoulder. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Shoulder construction shall be done in proper sequence in such a manner that adjacent ditches will be drained effectively and that no damage of any kind is done to the adjacent completed pavement. The completed shoulders shall be true to alignment and grade and shaped to drain in conformity with the cross section shown.

3.16 FINISHING

The surface of excavations, embankments, and subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. The degree of finish for graded areas shall be within 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades shall be specified in paragraph SUBGRADE PREPARATION. Swales shall be finished in a manner that will result in effective drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials. Settlement or washing that occurs in graded, topsoiled, or backfilled areas prior to acceptance of the work, shall be repaired and grades re-established to the required elevations and slopes.

3.16.1 Subgrade and Embankments

During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained to drain effectively at all times. The finished subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition until ballast, subbase, base, or pavement is placed. The storage or stockpiling of materials on the finished subgrade will not be permitted. No subbase, base course, ballast, or pavement shall be laid until the subgrade has been checked and approved, and in no case shall subbase, base, surfacing, pavement, or ballast be placed on a muddy, spongy, or frozen subgrade.

3.16.2 Capillary Water Barrier

Capillary water barrier under concrete floor and area-way slabs on grade shall be placed directly on the subgrade and shall be compacted with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.16.3 Grading Around Structures

Areas within 5 feet outside of each building and structure line shall be constructed true-to-grade, shaped to drain, and shall be maintained free of trash and debris until final inspection has been completed and the work has been accepted.

3.17 PLACING TOPSOIL

On areas to receive topsoil, the compacted subgrade soil shall be scarified to a 2 inch depth for bonding of topsoil with subsoil. Topsoil then shall be spread evenly to a thickness of 6 inches and graded to the elevations and slopes shown. Topsoil shall not be spread when frozen or excessively wet or dry. Material required for topsoil in excess of that produced by excavation within the grading limits shall be obtained from offsite areas.

3.18 TESTING

Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. If the Contractor elects to establish testing facilities, no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved by the Contracting Officer. Field in-place density shall be determined in accordance with ASTM D 2167. ASTM D 2937, Drive Cylinder Method shall be used only for soft, fine-grained, cohesive soils. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced and recompact to meet specification requirements. Tests on recompact areas shall be performed to determine conformance with specification requirements. Inspections and test results shall be certified by a registered professional civil engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.18.1 Fill and Backfill Material Gradation

One test per 50 cubic yards stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM D 1140.

3.18.2 In-Place Densities

- a. One test per 2,500 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.
- b. One test per 1,000 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.

3.18.3 Check Tests on In-Place Densities

If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556

as follows:

- a. One check test per lift for each 2,500 square feet, or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines.
- b. One check test per lift for each 1,000 square feet, of fill or backfill areas compacted by hand-operated machines.

3.18.4 Moisture Contents

In the stockpile, excavation, or borrow areas, a minimum of two tests per day per type of material or source of material being placed during stable weather conditions shall be performed. During unstable weather, tests shall be made as dictated by local conditions and approved by the Contracting Officer.

3.18.5 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 20 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.18.6 Tolerance Tests for Subgrades

Continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION shall be made during construction of the subgrades.

3.18.7 Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to 2.5 feet above the top of the pipe, the pipe shall be inspected to determine whether significant displacement has occurred. This inspection shall be conducted in the presence of the Contracting Officer. Pipe sizes larger than 36 inches shall be entered and examined, while smaller diameter pipe shall be inspected by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgement of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, the defects shall be remedied as directed at no additional cost to the Government.

3.19 DISPOSITION OF SURPLUS MATERIAL

Surplus material or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber shall be removed from Government property as directed by the Contracting Officer.

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SECTION 02312

EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 145	(1991; R 2003) Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
AASHTO T 180	(2001) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
AASHTO T 2	(2000) Sampling of Aggregates
AASHTO T 87	(1986; R 2000) the Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

ASTM INTERNATIONAL (ASTM)

ASTM C 136	(2001) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D 1556	(2000) Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 2922	(2001) Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3740	(2001) Standard Practice for Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used In Engineering Design and Construction
ASTM D 422	(2002) Standard Test Method for Particle-Size Analysis of Soils
ASTM D 4318	(2000) Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Record of Existing Conditions shall be submitted in accordance with the paragraph entitled, "Records of Existing Conditions," of this section.

The records shall include the following:

- Location of Underground Utilities
- Location of Approved Utilities
- Location of Test
- Location of Inspection

SD-02 Shop Drawings

As-Built Drawings shall be submitted in accordance with paragraph entitled, "Drawings," of this section.

SD-06 Test Reports

Test reports shall be submitted in writing by the Contractor for Soil Test results within 5 calendar days. Reports shall be according to the paragraph entitled, "Field Quality Control," of this section.

SD-07 Certificates

Certificates for the following shall be submitted by the Contracting Officer in accordance with the paragraph entitled, "Plans," of this section.

- Demolition Plan
- Work Plan
- Protection Plan

Certificates for Proposed Soil Materials shall be submitted by the Contracting Officer in accordance with paragraph entitled, "Proposed Soil Materials," of this section.

Certificates for Compost shall be submitted indicating grade and compliance to state and local regulations.

1.3 QUALITY ASSURANCE

Soil survey for satisfactory soil materials and samples of soil materials shall be furnished by the Contractor. A certified soil-testing service approved by the Contracting Officer shall be provided by the Contractor.

Testing shall include soil survey for satisfactory soil materials, sampling and testing soil materials proposed for use in the work, subbase materials at the mixing plant, and field-testing facilities for quality control during construction period.

Testing agencies shall conform to the requirements of ASTM D 3740.

1.4 PLANS

The Demolition Plan shall be approved by the Contracting Officer at least 48 hours in advance of the work. The plan shall include all special environmental consideration and safety precautions along with the coordination procedures for the protection plan and work plan of this phase of work.

A Work Plan shall be submitted including proposed methods of excavation, earth support, utility construction, and backfilling at least 48 hours in advance of the work, for approval by the Contracting Officer. The plan shall be coordinated with the demolition and protection plans of this section.

The Contractor shall provide a Protection Plan of existing utilities place, and coordinate the plan with the demolition plan.

1.5 DRAWINGS

As-Built Drawings shall be submitted in accordance with Section 01780, "Closeout Submittals."

1.6 RECORDS OF EXISTING CONDITIONS

The Contractor shall verify the existing conditions are correct as shown on the plans and mentioned in the specification. Any discrepancies found shall be noted immediately, and notification given to the Contracting Officer.

The records shall include Location of Underground Utilities, Location of Approved Utilities, Location of Test and Location of Inspection.

PART 2 PRODUCTS

2.1 STRUCTURAL MATERIALS

Materials used for shoring and bracing, such as sheet piling, uprights, stringers, and crossbraces, shall be in good serviceable condition. Any timber used shall be sound and free from large or loose knots.

2.2 BACKFILL MATERIAL

Backfill material shall consist of sandy clay, sand, gravel, soft shale, or other satisfactory soil materials.

2.2.1 Proposed Soil Materials

Soil materials proposed for use in the work shall be tested. The materials shall be approved by the Contracting Officer prior to start of work, as follows:

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Satisfactory soil materials	Sampling	AASHTO T 2	One for each source of material to determine conformance to definition of satisfactory soil materials; additional tests whenever there is any apparent change
	Preparation of samples	AASHTO T 87	
	Sieve analysis of fine and coarse aggregate	ASTM C 136	
	Mechanical analysis of soils	ASTM D 422	
	Liquid limit of soils	ASTM D 4318	
	Plastic limit and plasticity index of soils	ASTM D 4318	
	Moisture-density relations of soil	AASHTO T 180, Method B or D	

2.2.2 Satisfactory Materials

Satisfactory soil materials - AASHTO M 145 Soil Classification Groups A-1, A-2-4, A-2-5, and A-3.

2.2.3 Unsatisfactory Materials

Unsatisfactory soil materials - AASHTO M 145 Soil Classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7, highly organic soils, and soil materials of any classification that have a moisture content at the time of compaction beyond the range of 1 percentage point below and 3 percentage points above the optimum moisture content of the soil material as determined by moisture-density relations test.

2.3 TOPSOIL

Topsoil shall be any soil removed from the project site which consists of clay or sandy loam. The topsoil shall be reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and shall be free from stones, stumps, roots, and other objectionable materials larger than 2 inch in any dimension.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Before starting earthwork, the location of underground utilities shall be carefully verified by hand methods. Utilities to be left in place shall be protected from damage.

Excavation, filling, backfilling, and grading shall be to subgrade elevations specified.

Excavated materials suitable for backfill shall be piled in an orderly manner sufficiently distant from excavations to prevent overloading, slides, and cave-ins.

Excavations shall be done in ways that will prevent surface water and subsurface water from flowing into excavations and will also prevent flooding of the site and surrounding area.

3.2 PROTECTION OF PERSONS AND PROPERTY

Excavations shall be barricaded and posted with warning signs for the safety of persons. Warning lights shall be provided during hours of darkness.

Structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations shall be protected against damage including settlement, lateral movement, undermining, and washout.

Topsoil removal operations shall be conducted to ensure safety of persons and to prevent damage to existing structures and utilities, construction in progress, trees and vegetation to remain standing, and other property.

3.3 SHORING, BRACING, AND SHEETING

Shoring and bracing in excavations shall be maintained for the entire length of time excavations will be open. Shoring and bracing shall be carried down with the excavation.

Sheeting used to prevent lateral movement of soil shall be removed in accordance with the requirements.

Untreated sheeting shall not be left in place beneath structures or pavements.

3.4 TRENCH EXCAVATION

Trenches shall be of adequate width and depth for the specified purpose. Side slopes of the trenches shall be as nearly vertical as practicable. Care shall be taken not to overexcavate. Bottoms of the trenches shall be accurately graded to provide uniform bearing and support for each section of pipe on undisturbed soil at every point along its entire length except where it is necessary to excavate for bell holes and for proper sealing of pipe joints. Bell holes and depressions for joints shall be dug after the trench bottom has been graded to ensure that the pipe rests on the prepared bottom for as much of its full length as practicable. Bell holes and

depressions shall be only of such length, depth, and width as required to make the joint. Stones shall be removed, as necessary, to avoid point bearing. Where rock excavation is required in trenches for pipe, the rock shall be excavated to a minimum overdepth of 6-inches below the trench depth specified. Except as specified for wet or otherwise unstable material, overdepths shall be backfilled with materials specified for backfilling the lower portion of trenches. Whenever wet or otherwise unstable material that is incapable of properly supporting the pipe, as determined by the Contracting Officer, is encountered in the bottom of the trench, it shall be removed and the trench shall be backfilled to the proper grade with coarse sand, fine gravel, or other suitable, approved material.

Trench excavations in surfaced areas shall be by open cut, unless otherwise shown. The pavement shall be cut by concrete saw or other approved method. Cuts shall be in straight lines parallel to the utility line location and shall be to a depth of at least one quarter of the pavement thickness. The remainder of the pavement shall be broken out. Pavement shall be removed a minimum of 12 inches on each side of the trench and 6 inches beyond where the base course is to be removed.

3.5 WATER REMOVAL

Water shall not be permitted to accumulate in excavations. Dewatering systems shall be provided by the Contractor to convey water away from excavations so that softening of foundation bottoms, footing undercutting, and soil changes detrimental to subgrade stability and foundation will not occur. Dewatering systems and methods of disposal shall be approved by the Contracting Officer.

Dewatering shall be continued until construction subject to water pressure has obtained full specified strength and backfill is completed.

Water removal from excavations shall be conveyed to approved collecting or runoff areas. Temporary drainage ditches and other diversions as necessary shall be provided and maintained outside of excavation limits.

Trench excavations for utilities shall not be used for temporary drainage ditches.

3.6 EXCAVATION FOR SANITARY SEWERS AND STORM SEWERS

The width of the trench at and below the top of the pipe shall be such that the clear space between the barrel of the pipe and the trench wall shall not exceed 8 inches or be less than 5 inches on either side of the pipe. The width of the trench above that level shall be as wide as necessary for sheeting and bracing and for the proper performance of the work.

For pipe indicated resting on the trench bottom, the bottom of the trench shall be rounded so that the pipe shall nest firmly on undisturbed soil for as nearly the full length of the barrel (as proper jointing operations will permit). This part of the excavation shall be done manually only a few feet in advance of the pipe being laid.

Depth of excavation for gravity sewer lines shall permit the installation of the pipe at the flow line elevations shown on the plans.

3.7 EXCAVATION FOR WATER DISTRIBUTION SYSTEM

Water mains shall be layed to the depth and grade shown on the plans.

3.8 EXCAVATION FOR GAS DISTRIBUTION SYSTEM

Trenches for gas distribution lines shall be excavated to a depth that will provide not less than 2 feet of cover over the top of the pipe from the existing ground surface or from the indicated finished grade (whichever is lower).

3.9 EXCAVATION FOR ELECTRICAL UTILITIES

Excavation of trenches for electrical cables and duct lines shall provide vertical walls, unless otherwise approved by the Contracting Officer, and the trench shall be only as wide as necessary for workers to install the cables or ducts. Abrupt changes in grade of the trench bottom shall be avoided. Trenches shall be of a depth to provide a minimum cover over the top of the cables or ducts of 2-feet below finished grade, and at additional depth if necessary to avoid interference of the electrical cables or ducts with other utilities.

3.10 EXCAVATION FOR APPURTENANCES

Excavation for manholes and similar structures shall be sufficient to leave at least 12 inches in the clear between the outer surfaces and the embankment or timber used to hold and protect the walls. Any overdepth excavation below such appurtenances that has not been directed will be considered unauthorized and shall be refilled with select bedding material or concrete, as directed by the Contracting Officer, at no additional cost to the Government.

3.11 BORING AND JACKING

Where utilities beneath concrete and asphaltic pavement shall be installed by boring and jacking, The boring and jacking installation shall be performed by workers experienced in such operations, with equipment designed and regularly used for this work. The bored opening shall be kept to the minimum size practical for the installation of the utility. When a void greater than 1 inch exists between the bored opening and outside edge of the utility installation, the void shall be filled with grout under pressure, as approved by the Contracting Officer.

3.12 BACKFILLING AND COMPACTION

Where trench sheeting is pulled, withdrawal shall be in increments of not more than 1 foot and backfilling and compaction operations shall be carried on simultaneously with trench sheeting pulling.

Trenches shall not be backfilled until required tests are performed and until the utilities systems, as installed, conform to the requirements for

the installation of the various utilities. Trenches improperly backfilled shall be reopened to the depth required for proper compaction, then refilled and compacted as specified, or the condition shall be otherwise corrected as directed.

3.12.1 Bedding

Where the trench is excavated in rocks, a minimum of 6 inches of specified bedding material shall be placed on the rock surface before laying conduit or electrical cable.

3.12.2 Backfill Around Pipe

Backfill around pipe shall be applied to 6-inches above pipe with the specified bedding material.

3.12.3 Lower Portion of Trench

Backfill material shall be deposited in 8-inch uncompacted layers and compacted to the density of the adjacent soil until there is a cover of not less than 1 foot. The backfill material in this portion of the trench shall consist of sandy clay, sand, gravel, soft shale, or other approved materials, free from hard clods and stones larger than 1 inch in any dimension.

3.12.4 Remainder of Trench

The remainder of the trench shall be backfilled with material that is free of stones larger than 3 inches in any dimension. Backfill material shall be deposited in layers not exceeding the thickness specified, and each layer shall be compacted to the minimum density specified.

Under concrete slabs and paved parking areas:

6-inch layers, 95 percent of maximum density prescribed in AASHTO T 180, Method B or D

Under other areas:

8-inch layers, 90 percent of maximum density prescribed in AASHTO T 180, Method B or D

3.13 FIELD QUALITY CONTROL

The Contractor shall arrange his Soil Test work so that sampling and testing may be performed without interruption. Moisture-density relations shall be determined in accordance with AASHTO T 180, Method B or D. Field density tests shall be performed by methods in sufficient number to ensure that the specified density is obtained.

Soil materials shall be tested during construction as follows:

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>MATERIAL TESTED AND NUMBER OF TESTS</u>
Soil material- in-place after compaction	Density of soil-in-place	ASTM D 1556, Sand Cone Method or ASTM D 2922, Nuclear Method (when approved by Con- tracting Officer)	At least three daily for each subgrade soil material, and for each layer of soil mate- rial; addition- al test when- ever there is in moisture

3.14 RESTORATION OF SURFACES

Areas within the limits of earthwork under this section, including adjacent transition areas, shall be uniformly graded. The finished surface shall be smooth within the specified tolerances, compacted, and with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

Grassed areas:

The finished surface of areas to receive topsoil blend shall be not more than 0.10-foot above or below the specified finish elevations.

Walks:

The surface of areas under walks shall be shaped to line, grade, and cross section, and the finished surface shall be not more than 0.0 foot above or 0.10-foot below the specified finish elevations.

Pavements:

The surface of areas under pavements shall be shaped to line, grade, and cross section, and the finished surface shall be not more than 1/2-inch above or below the specified finish elevations.

3.15 DISPOSAL OF EXCESS AND WASTE MATERIALS

Excess excavated satisfactory materials shall be transported to, and disposed in, designated storage areas on Government property.

Waste materials, including excavated material classified as unsatisfactory soil material, trash, and debris, shall be removed from Government property and legally disposed of, by the Contractor.

-- End of Section --

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SECTION 02315

EXCAVATION AND FILL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO T 180 (2001) Moisture-Density Relations of Soils
Using a 4.54-kg (10-lb) Rammer and a
457-mm (18-in.) Drop

ASTM INTERNATIONAL (ASTM)

ASTM C 117 (2003) Standard Test Method for Materials
Finer than 75-micrometer (No. 200) Sieve
in Mineral Aggregates by Washing

ASTM C 136 (2001) Standard Test Method for Sieve
Analysis of Fine and Coarse Aggregates

ASTM D 1556 (2000) Standard Test Method for Density
and Unit Weight of Soil in Place by the
Sand-Cone Method

ASTM D 1557 (2002e1) Standard Test Methods for
Laboratory Compaction Characteristics of
Soil Using Modified Effort (56,000
ft-lbf/ft³) (2700 kN-m/m³)

ASTM D 2216 (1998) Standard Test Method for Laboratory
Determination of Water (Moisture) Content
of Soil and Rock by Mass

ASTM D 2922 (2001) Standard Test Methods for Density
of Soil and Soil-Aggregate in Place by
Nuclear Methods (Shallow Depth)

ASTM D 3282 (1993; R 1997e1) Standard Classification
of Soils and Soil-Aggregate Mixtures for
Highway Construction Purposes

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926 (2001) Safety and Health Regulations for
Construction

1.2 DEFINITIONS

Satisfactory materials shall mean ASTM D 3282, Soil Classification Groups A-1, A-2-4, A-2-5, and A-3.

Unsatisfactory soil materials shall mean ASTM D 3282, Soil Classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7, peat and other highly organic soil, and soil materials of any classification that have a moisture content at the time of compaction beyond the range of 1 percentage point below and 3 percentage points above the optimum moisture content of the soil material as determined by moisture-density relations test.

Subgrade shall mean the top surface of a backfill or fill or the uppermost surface of an excavation, graded to conform to the required subgrade elevation and compacted to support a structure.

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure in AASHTO T 180, Methods B or D.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Construction Equipment List shall be submitted.

Records of Underground Utilities shall be submitted for the following items:

Location of Inspections
Location of Testing
Location of Utility Approvals

SD-06 Test Reports

Contractor shall submit written Test Reports of Soil Test results within 5 calendar days. Submit test reports in accordance with paragraph entitled, "Quality Control Testing During Construction," of this section.

SD-07 Certificates

Certificates of Compliance for Compost shall be submitted indicating grade and compliance to state and local regulations.

1.4 QUALITY CONTROL TESTING DURING CONSTRUCTION

Soil materials shall be tested by the Contractor during construction as follows:

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Soil materials specified	Sieve analysis of fine and coarse aggregates	ASTM C 136	One daily for each soil material from each source; additional test whenever there is any apparent change
	Amount of material passing No. 200 sieve	ASTM C 117	
	Moisture content of subbase material	ASTM D 2216	
Soil materials prior to compaction	Moisture-density relations of soil	ASTM D 1557	One of each type of subgrade soil material except under backfill for structures; one for each backfill and fill material from each source
Soil material-in-place after compaction	Density of soil-in-place	ASTM D 1556 Sand Cone Method or ASTM D 2922 Nuclear Method	At least three daily for each subgrade soil material except under backfill for structures, and for each layer and backfill and fill material; additional test whenever there is any change in moisture conditions

1.5 TEST REPORTS

No soil material shall be used until a written report of Soil Test results has been reviewed and approved by the Contracting Officer.

1.6 CONSTRUCTION EQUIPMENT LIST

Construction Equipment List for all major equipment to be used in this section shall be submitted to the Contracting Officer prior to start of work.

1.7 UNDERGROUND UTILITIES

Records of Underground Utilities Location of Inspections, Location of Testing and Location of Utility Approvals shall be submitted to the Contracting Officer prior to start of work.

PART 2 PRODUCTS

2.1 BACKFILL AND FILL MATERIALS

Materials for backfill and fill shall be free of clay clods, rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, and other deleterious matter and shall be satisfactory soil materials as follows:

<u>AREA CLASSIFICATION</u>	<u>BACKFILL OR FILL MATERIALS</u>
In excavations, unless otherwise specified	Borrow material that has been sampled, tested, and approved as "Satisfactory Soil Material". Include well graded 3/4 inch minus and 3 inch minus road base.
Against face of structures where footing drains from top of porous fill for footing drains to indicated elevation, and from face of structure a distance equal to three footing drain diameters	Filtering material
Against surfaces having applied waterproofing for a distance of at least 6 inches from surface	Sand
In foundation subdrain trenches over porous fill drain pipe	Filtering material
Under grassed areas	Excavated or borrow material that has been sampled, tested, and approved as "Satisfactory Soil Material"

AREA CLASSIFICATIONBACKFILL OR FILL MATERIALS

Under walks, steps,
and paved areas

Subbase material or exca-
vated or borrow material
that has been sampled,
tested, and approved as
"Satisfactory Soil
Material"

Under building slabs

Borrow mate-
rial that has been sampled,
tested, and approved as
"Satisfactory Soil
Material". Include well
graded 3/4 inch minus and 3
inch minus road base.

2.2 Satisfactory Materials

Satisfactory materials shall mean AASHTO M 145, (ASTM D 3282) Soil Classification Groups A-1, A-2-4, A-2-5, and A-3.

2.3 Unsatisfactory Materials

Unsatisfactory soil materials shall mean AASHTO M 145, Soil Classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7, peat and other highly organic soil, and soil materials of any classification that have a moisture content at the time of compaction beyond the range of 1 percentage point below and 3 percentage points above the optimum moisture content of the soil material as determined by moisture-density relations test.

2.4 BACKFILL AND FILL MATERIALS

Materials for backfill and fill shall be satisfactory soil materials, free of clay clods, rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, and other deleterious matter.

2.5 TOPSOIL

Topsoil shall be any soil removed from the project site which consists of clay or sandy loam. The topsoil shall be reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and shall be free from stones, stumps, roots, and other objectionable material larger than 2 inches in any dimension.

2.6 COMPACTION EQUIPMENT

Compaction equipment shall consist of sheepfoot rollers, pneumatic-tired rollers, tamper rollers, vibrating tampers, or other compaction equipment capable of obtaining the required density throughout the entire layer.

PART 3 EXECUTION

3.1 GENERAL

Before earthwork is started, the location of Underground Utilities shall be verified by hand methods. Utilities to be left in place shall be protected from damage.

Excavations shall be done in ways that will prevent surface water and subsurface water from flowing into excavations and will also prevent flooding of the site and surrounding area.

3.2 SURFACE PREPARATION

Heavy growths of grass and other vegetation, roots, debris, stones, objects larger than 2 inches in any dimension, and other materials undesirable to the subsurface construction shall be removed by mowing, grubbing, raking, or other methods from the surface of areas to be stripped.

3.2.1 Stripping

Topsoil shall be stripped from the surface of those areas to receive fills or embankments.

Excavated topsoil shall be transported to, and stockpiled in, designated topsoil storage areas.

3.2.2 Clearing Operations

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within the areas to be cleared. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be completely removed except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter and of live branches to the indicated height. Live limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branches. Cuts made shall be painted with tree-wound paint. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require.

3.2.3 Grubbing Operations

Contractor shall completely remove stumps, roots, and organic or other debris protruding through the ground surface. This material shall be excavated and removed to a depth of not less than 8 inches below the surface level of the original ground. Mechanical grubbing equipment shall not be used inside the drip lines of trees indicated to remain standing.

3.2.4 Filling Depressions

Depressions resulting from grubbing operations shall be completely filled with acceptable backfilling material, unless further excavation or

earthwork is required.

Prior to filling, subgrade surfaces of depressions shall be free of standing water, frost, or frozen material. Unsatisfactory soil materials shall be removed.

Contractor shall place fill material in horizontal layers not to exceed 6 inches in loose depth. Each layer shall be compacted at the optimum moisture content to a density equal to the original adjacent ground. Surface of filled depressions shall be graded to meet adjacent contours and to provide surface water drainage.

3.3 EXCAVATION

3.3.1 Stability of Sides

Sides of excavations over 5 feet in depth shall be sloped not steeper than 34 degrees from the horizontal (slope 1/1.5) of the material excavated or shall be shored and braced where sloping is not possible because of space restrictions, stability of material excavated, or where excavations are subjected to vibrations from vehicular traffic, the operation of machinery, or any other source.

Sides and slopes of excavations shall be maintained in a safe condition by scaling, benching, shelving, or bracing until completion of backfill placement.

3.3.2 Shoring and Bracing

Contractor shall adhere to and enforce precautions as outlined in OSHA Regulations, 29 CFR 1926, Subpart P.

3.3.3 Water Removal

Water shall not be permitted to accumulate in excavations. Dewatering systems shall be provided by the Contractor to convey water away from excavations so that softening of foundation bottoms, footing undercutting, and soil changes detrimental to subgrade stability and foundation will not occur. Dewatering systems and methods of disposal shall be approved by the Contracting Officer.

Dewatering shall be continued until construction subject to water pressure has obtained full specified strength and backfill is completed.

Water removal from excavations shall be conveyed to approved collecting or runoff areas. Temporary drainage ditches and other diversions shall be provided by the Contractor and maintained outside of excavation limits.

Trench excavations for utilities shall not be used for temporary drainage ditches.

3.3.4 Excavation For Structures

Excavation for structures shall conform to the dimensions and elevations

indicated in the Construction Documents within a tolerance of plus or minus 0.10 foot and shall extend a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services and other construction indicated, and for inspection.

In excavating for footings and foundations, care shall be taken not to disturb the bottom of the excavation. Excavation to final grade shall be done just before concrete is placed. Bottoms shall be trimmed to the required lines and grades to leave a solid bed to receive concrete.

3.3.5 Excavation of Ditches, Gutters, and Channels

Excavation shall be accomplished by cutting accurately to the cross sections, grades, and elevations indicated. Excessive open-ditch or gutter excavation shall be backfilled with suitable materials to grade at no additional cost.

3.3.6 Excavation for Drainage Structures

Excavation shall be made accurately to the lines, grades, and elevations indicated. Dimensions and elevations of footings and foundation excavations are only approximate and may be changed if necessary to ensure adequate foundation support. Trenches and foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as indicated. Rock or other hard foundation materials shall be cleaned of loose debris and cut to a firm surface, either level, stepped, or serrated, as indicated. Loose disintegrated rock and thin strata shall be removed. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before concrete or masonry is to be placed.

3.3.7 Trench Excavation

Trenches shall be of adequate width and depth for the specified purpose. Side slopes of the trenches shall be as nearly vertical as practicable. Bottoms of the trenches shall be accurately graded to provide uniform bearing and support for each section of pipe on undisturbed soil at every point along its entire length except where it is necessary to excavate for bell holes and for proper sealing of pipe joints. Bell holes and depressions for joints shall be dug after the trench bottom has been graded to ensure that the pipe rests on the prepared bottom for as much of its full length as practicable. Bell holes and depressions shall be only of such length, depth, and width as required to make the joint. Stones shall be removed, as necessary, to avoid point bearing. Where rock excavation is required in trenches for pipe, the rock shall be excavated to a minimum overdepth of 6 inches below the trench depth specified. Except as specified for wet or otherwise unstable material, overdepths shall be backfilled with materials specified for backfilling the lower portion of trenches.

3.3.8 Removal of Unsatisfactory Soil Materials

Unsatisfactory soil materials encountered that extend below the required elevations shall be excavated to the depth directed by the Contracting Officer.

3.4 FILLING AND BACKFILLING

3.4.1 Preparations Prior to Backfill Placement

Excavations shall be backfilled as promptly as the work permits but not until completion of the following:

- Approval of construction below finish grade

- Inspection, testing, approval, and recording location of underground utilities

- Removal of concrete formwork

- Removal of shoring and bracing; backfilling of voids with satisfactory soil material; temporary sheet piling driven below bottom of structures; and cutting off and removing of utilities in a manner that prevents settlement of the structure or utilities

- Removal of trash and debris

- Completion of concrete waterproofing

3.4.2 Preparation of Ground Surface to Receive Fill

Vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials shall be removed from ground surface prior to the placement of fill. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stripped, or broken up in such manner that fill material will bond with the existing material.

When the ground surface has a density less than that specified for the particular area classification, the ground surface shall be broken up, pulverized, moisture-conditioned to near optimum moisture content of the soil material, and compacted to the required depth and percentage of maximum density.

3.4.3 Placement and Compaction

Backfill and fill materials shall be placed in layers not more than 6 inches in loose depth. Before compaction, each layer of backfill or fill material shall be moistened or aerated as necessary to provide the optimum moisture content of the soil material and shall then be compacted to the percentage of maximum density for each area classification. Backfill or fill material shall not be placed on surfaces that are muddy, frozen, icy, or contain frost.

Backfill and fill materials adjacent to structures shall be brought up evenly around structures and shall be carried up to the indicated

elevations.

Compaction adjacent to structures, within a horizontal distance from the face of the structure equal to the depth of backfill or fill material (measured from the bottom of footing or bottom of foundation or retaining wall) to final grade, shall be done with power-driven hand tampers.

3.5 COMPACTION

3.5.1 Percentage of Maximum Density Requirements

Actual density of each layer of soil material-in-place shall be not less than the following percentages of the maximum density of the same soil material determined by the moisture-density test.

<u>AREA CLASSIFICATION</u>	<u>PERCENT MAXIMUM DENSITY</u>
Grassed areas	85
Walks	95
Structures	95
Building slabs and steps	95
Utility trenches	95

3.5.2 Moisture Control

Moisture content in soil material at time of compaction shall be within specified limits.

Where the moisture content of a layer of soil material is below optimum before compaction, the required amount of water shall be uniformly applied to the surface of the layer of soil material and the layer of soil disked or otherwise mixed until a uniform moisture content is reached.

Where the moisture of a layer of soil material is above optimum, it shall be dried.

3.6 GRADING

3.6.1 General

Areas within the limits of grading under this section, including adjacent transition areas, shall be uniformly graded. Finished surface shall be smooth within the specified tolerances, compacted, and with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

3.6.2 Grading Surface of Fill Under Structures

Surface of fill under building slabs shall be smooth and even, free of voids, compacted as specified and to indicated grade within the specified

tolerances. When tested with a 10-foot straightedge, parallel with and at right angles to the building lines, the finished surface shall show no deviation in excess of 1 inch.

3.6.3 Grading Outside Building Lines

Areas outside the building lines for each structure shall be graded to drain away from the structure and to prevent ponding of water after rains. Finished surface shall be within the tolerance specified below for each area classification, compacted as specified, and free from irregular surface changes.

3.6.3.1 Grassed or Planted Areas

Finished surface of areas to receive topsoil blend shall be not more than 0.10 foot above or below the indicated subgrade elevations.

3.6.3.2 Walks

Surface of areas under walks shall be shaped to line, grade, and cross section; finished surface shall be not more than 0.0 foot above or 0.10 foot below the indicated subgrade elevation.

3.7 MAINTENANCE

3.7.1 Protection of Graded Areas

Newly graded areas shall be protected from traffic and erosion and shall be maintained free of trash or debris.

3.7.2 Reconditioning Compacted Areas

Where approved compacted areas are disturbed by subsequent construction operations or adverse weather, the surface shall be scarified, reshaped, and compacted as specified to the required density prior to further construction.

3.8 DISPOSAL OF EXCESS AND WASTE MATERIALS

Excess excavated satisfactory materials shall be transported to and disposed in designated storage areas on Government property.

Waste materials, including excavated material classified as unsatisfactory soil material, trash, and debris, shall be removed from Government property and legally disposed at no additional cost to the Government. Permits and fees for disposal shall be paid by the Contractor.

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SECTION 02473

DRILLED CONCRETE PIERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

30 CFR (1994) Mineral Resources, Chapter 1

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Construction Equipment List shall be submitted.

SD-02 Shop Drawings

Fabrication and erection Drawings shall be submitted for the following proposed items:

Shoring
Bracing
Steel Casing
Safety Tubes
Reinforcing Steel Details
Dowels and Anchor Bolts

SD-03 Product Data

Manufacturer's catalog data shall be submitted on all major equipment to be used, in accordance with paragraph entitled, "Construction Equipment List," of this section.

SD-06 Test Reports

Test report shall be submitted in accordance with paragraph entitled, "Reports," of this section.

Gas test shall be submitted in accordance with paragraph entitled, "Gas Protection," contained within this section.

Other test reports are to include:

Concrete Test

The Contractor shall submit the following records in accordance with the applicable paragraph's contained within this section:

Daily Progress Report
Drilling Record for Each Pier
Record of Gas Readings
Inspection Notices

SD-07 Certificates

A Listing of Product Installations shall be submitted in accordance with paragraph entitled, "Listing of Product Installations," of this section.

Qualification of gas inspector shall be submitted in accordance with the paragraph entitled, "Gas Protection," of this section.

Submit safety plan in accordance with paragraph entitled, "Safety Provisions," of this section.

1.3 DEFINITION OF DRILLED PIER

A drilled pier shall mean an end bearing and/or skin friction bearing cast-in-place concrete foundation with a minimum diameter of 12-inches, formed by machine-drilling a hole to the specified depth and filling with concrete and reinforcing steel.

1.4 PROGRESS REPORTS AND RECORDS

Contractor shall submit a Daily Progress Report and Drilling Record for Each Pier. Report shall contain the date of starting work and depth drilled per day.

1.5 PROTECTION OF WORK

Drilled piers shall be protected from damage due to premature use, mechanical disturbances, shock or vibration, undermining, and washout.

1.6 SAFETY PROVISIONS

1.6.1 Steel Casings

Full-length steel casings of sufficient thickness shall be provided as necessary to withstand compressive displacement and withdrawal stresses and to maintain walls of the excavation. Casings may be left in place or may be pulled as concrete is placed, at the Contractor's option, unless otherwise directed.

1.6.2 Hoists and Safety Devices

Approved safety devices and safe means of ingress to and egress from the bottom of excavations shall be provided for personnel. Each person shall

be provided with a properly rigged safety harness and life line. The life line shall be separate from other lines. Persons being raised or lowered in the shaft by means of a bucket shall be required to wear safety belts.

Properly trained safety personnel shall be provided at the top of the pier shaft when workmen or inspectors are in the shaft. Safety personnel shall be responsible for the safety of persons in the shaft and shall relay lift signals to the hoist operator.

Adequate stand-by mechanical equipment shall be provided for emergency use.

1.6.3 Gas Protection

Applicable rules of 30 CFR shall be observed for pier excavation and work in soils known or suspected to be gaseous.

Persons other than a qualified gas inspector shall not enter a drilled pier until air has been checked for toxic and explosive gases and approved for entry.

The Contractor shall have employees trained in the operation of gas-testing equipment and qualified as gas inspectors who shall be on duty when workmen are in the drilled piers. The inspectors' primary function shall be to test for gas and be responsible for operation of testing equipment. Unless equipment of the constant supervisory type with automatic alarm is employed, tests for gas shall be made at intervals of 2 hours, or less when the character of the ground or experience indicates that gas may be encountered. A test for gas shall be made before workmen are permitted to enter the excavation after an idle period exceeding 1/2 hour.

Readings shall be made with approved instruments by the gas inspector. Readings shall indicate the concentration of gas, number and location of drilled piers, point of test, and date and time of test. Readings shall be entered as a permanent Record of Gas Readings.

Air in drilled piers shall be maintained free of gas and shall be ventilated by means of positive mechanical ventilation. Supply air shall be delivered at a point 10 feet or less from the bottom of the pier.

If gas is found to be present in an amount constituting an explosive mix or health hazard, work in the drilled pier shall be suspended until air is made safe for work by special ventilation methods or the method of excavation is changed to prevent entrance of gas.

1.7 SAMPLING AND TESTING

A sampling and testing service shall be provided by the Contractor. Testing services shall be approved and shall perform sampling and testing for quality control.

Except when specified otherwise, one laboratory report shall be submitted for each reference specification. Additional reports will be required if material or material source changes.

A Qualified Engineer or Technician under the supervision of a Qualified Engineer from a COE Certified Laboratory be on site at all times during caisson work. A log for each caisson shall be maintained by the Qualified Engineer or Technician detailing depth, plumbness, clean bottom of hole, water intrusion, rebar cage position, and consolidation of concrete during placement. These logs shall be submitted for approval to the Corps upon completion of each Caisson.

1.8 CONSTRUCTION EQUIPMENT LIST

Construction Equipment List for all major equipment to be used in this section shall be submitted to the Contracting Officer prior to start of work.

1.9 SHOP DRAWINGS

Fabrication and erection drawings shall be submitted for Shoring, Bracing, Steel Casing, Safety Tubes, Reinforcing Steel Details and Dowels and Anchor Bolts to specification as described in the plans, prior to the start of work.

1.10 LISTING OF PRODUCT INSTALLATIONS

A Listing of Product Installations similar to the specified work contained within this section shall be submitted. The written statement shall include the proposed pier organization giving qualification of personnel. The written statement should show proof of at least five years experience by the organization in this particular type of foundation work. Personnel working pursuant to this section, may at the Contracting Officer's option, be required to demonstrate technical competence by performing sample work and/or by displaying their state qualifications/certificates, at no additional cost to the Government.

PART 2 PRODUCTS

2.1 CONCRETE

Concrete shall be Class 3A and conform to the requirements of Section 03300 CAST-IN-PLACE CONCRETE.

2.2 REINFORCEMENT

Reinforcement shall conform to Section 03300 CAST-IN-PLACE CONCRETE and shall be Grade 10.

PART 3 EXECUTION

3.1 PIER DRILLING

3.1.1 General

Holes for piers shall be drilled to the depth indicated.

Casings shall be installed as the drilling proceeds when necessary so that

earth walls are maintained without movement into the shaft excavation. Particular care shall be exercised in withdrawing temporary casings, as specified under concrete placing.

In the event that casings are required, the Contractor may abandon casings, provided no extra expense to the Government is involved, or casings may be removed in lifts as each lift of concrete is placed in such a manner that the bottom of the casings remains below the top of the concrete being placed and the head of the concrete above the bottom of the casing is greater than that of any drilling mud and water on the outside of the casing, until the top of the concrete is level with or above unstable earth.

3.1.2 Drilling Tolerances

The centerline of the shaft and bell of drilled piers shall be on the centerline of columns or walls unless otherwise indicated.

The actual center of each pier shaft shall be within 2 inch of the design center at the cutoff line. Its center at any other horizontal plane shall not be out of plumb from the designed center at the cutoff line by more than 1 percent of the distance from the cutoff line to the particular horizontal plane struck, but the center shall not deviate from the actual vertical axis of the pier more than 5 percent of its design diameter at such plane.

The maximum tolerance from plumb in any one hole, measured in center of hole, shall not exceed 1/16-inch per foot of depth.

If these tolerances are exceeded, proper additional construction as required shall be provided without additional cost to the Government.

3.1.3 Removal of Obstructions

Substructures and other obstructions below grade that interfere with the work shall be demolished and removed. Underground utilities encountered during drilling shall be protected until proper identification is made. If utilities are abandoned, the interfering portions shall be removed as obstructions. If utilities are to remain in service, the Government will provide for relocation.

If, during the process of drilling excavation, unforeseen obstructions, concrete or masonry substructures, boulders, or underground utility lines are encountered and not indicated on drawings, the Contractor shall cease work immediately and make a report in writing. The Contractor will be instructed as to the proper procedure.

3.1.4 Dewatering

If excessive water is encountered, the Contractor may either pregrout, excavate by pneumatic methods, or use other approved means to reduce or prevent entry of excessive water into the excavation.

Discharge lines shall be provided and maintained to carry water away from areas of building construction and to conduct the water to general site

run-off ditches and disposal areas. Additional ditching required to connect to site drainage shall be provided.

3.1.5 Inspection

Pier shafts shall be inspected and approved before concrete placing is permitted.

The Contractor shall provide facilities to inspect and measure each pier shaft.

Inspection Notices shall be submitted at least 6 hours prior to the time piers will be ready for inspection and testing.

3.1.6 Overexcavation

The Contractor will not be paid for overexcavation when pier holes are drilled to a greater depth than required. Overexcavation shall be filled with concrete. Such piers shall be measured and costs will be paid in accordance with the design length only.

3.1.7 Placing Reinforcement

Reinforcement shall be placed in accordance with Section 03300 CAST-IN-PLACE CONCRETE. Provide 2' - 4" sonotubes at the top of the pier to prevent "mushrooming" of the concrete.

3.1.8 Anchor Bolts

The Contractor shall set to template all anchor bolts, leveling plates, and accessories furnished under work of other sections.

3.2 PLACING CONCRETE

Concrete shall be placed in accordance with Section 03305 CAST-IN-PLACE CONCRETE (SHORT SECTION).

3.3 DISPOSAL OF WASTE MATERIALS

3.3.1 Removal to Spoil Areas on Government Property

Waste material shall be transported to and disposed of in designated spoil areas on Government property.

3.3.2 Removal from Government Property

Excavated materials shall be removed from Government property and legally disposed at no additional cost to the Government. Permits and fees for disposal shall be paid by the Contractor.

3.4 REPORTS

Five copies of each test report shall be submitted within 4 calendar days after completion of tests. In addition, a test report for each pier shall

be included.

Concrete Test shall be submitted in accordance with Section 03305
CAST-IN-PLACE CONCRETE (SHORT SECTION).

-- End of Section --

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SECTION 02515

WATER SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	(2003) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C105	(1999) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110	(1998) Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. (76 mm through 1219 mm), for Water Erratum: October 1999
AWWA C111	(2000) Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	(1999) Flanged Ductile-Iron Pipe with Ductile-Iron or Grey-Iron Threaded Flanges
AWWA C151	(2002) Ductile-Iron Pipe, Centrifugally Cast for Water or Other Liquids
AWWA C500	(2002; Addendum C500A - 1995) Metal Seated Gate Valves for Water Supply Service
AWWA C651	(1999) Disinfecting Water Mains
AWWA C900	(1997) Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. Through 12 in. for Water Distribution

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	(2003) Bronze Gate, Globe, Angle and Check Valves
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1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

The following drawing types shall be submitted in accordance with paragraph entitled, "Shop Drawings," of this section.

Erection/Installation Drawings
As-Built Drawings

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Cast-Iron/Ductile-Iron Pipe
Pipe Connections
Rubber Gaskets
Plastic Pipe and Fittings
Gate Valves
Tapped Tees
Corporation-Type Stops
Service Stops
Service Boxes

SD-06 Test Reports

Test reports for the following items shall be submitted in accordance with the paragraph entitled, "Testing," of this section.

Hydrostatic Test
Pressure Test
Leakage Test
Sterilizing

SD-08 Manufacturer's Instructions

Manufacturer's instructions including special provisions required to install equipment, components, and systems packages shall be submitted for the following. Special notices shall detail impedances, hazards and safety precautions.

Pipe Connections
Rubber Gaskets
Plastic Pipe and Fittings
Gate Valves
Tapped Tees
Corporation Stops
Service Stops
Service Boxes

1.3 LIMITS OF CONSTRUCTION

Work in this section relates to excavation, fill, and backfill to a point 5 feet beyond the building or structure line.

1.4 SHOP DRAWINGS

Erection/Installation Drawings shall be submitted by the Contractor for the complete water system prior to start of work.

As-Built Drawings shall be submitted by the Contractor for the complete water system prior to start of work.

PART 2 PRODUCTS

2.1 PIPING

2.1.1 Cast-Iron/Ductile-Iron Pipe

Ductile-iron pipe shall be in accordance with AWWA C151, Class 50 with mechanical or push-on joints.

Cement-mortar lining shall be in accordance with AWWA C104/A21.4.

Polyethylene encasement shall be in accordance with AWWA C105.

Cast-iron fittings shall be in accordance with AWWA C110.

Cast-iron pipe flanges and flanged fittings shall conform to ASME B16.1.

Flanged and threaded ductile-iron pipe shall be in accordance with AWWA C115.

Coal-tar protective coating shall be in accordance with AWWA C203.

Cement-mortar lining for pipe 4 inches and larger shall conform to AWWA C205.

Cold-applied tape coating of fittings shall be in accordance with AWWA C209.

Intermediate factory-made joints shall be oversized male and female threaded. Field joints shall be bell-and-spigot with or without factory-made lead joints or oversize male and female threaded type. Pipelines with threaded joints shall be provided with a packing-ring expansion joint at intervals of not more than 108 feet.

2.1.2 Pipe Connections

Bolts, nuts, and washers shall be in accordance with the recommendations of the pipe manufacturer.

2.1.3 Rubber Gaskets

Rubber-gasket joints for cast-iron pipe, gaskets, and lubricant shall conform to the applicable requirements of AWWA C111. Gaskets shall be in accordance with recommendations of the pipe manufacturer for steel pipe. Joints for reinforced-concrete pipe shall be the rubber gasket type using a bell-and-spigot joint design of steel. Joints shall be so designed that, when the pipe is laid and the joint completed, the gasket will be completely enclosed. Rubber gaskets shall be the sole element depended

upon for water tightness. Gaskets shall be continuous rings of the necessary size and cross section to fill the recess provided and shall conform to the recommendations of the pipe manufacturer, as applicable. Connections between cement pipe and cast-iron fittings or gate valves shall be made with approved materials recommended by the pipe manufacturer.

2.1.4 Plastic Pipe and Fittings

Solvent weld pipe shall be extruded of an improved polyvinylchloride (PVC) virgin pipe compound. Compound shall conform to ASTM D 1784, Cell Classification 12454-B, and have a 220 psi hydrostatic design stress rating. Pipe and fittings shall conform to AWWA C900.

Pipe shall bear the following markings: manufacturer's name, nominal pipe size, schedule or class, pressure rating in psi, and NSF (National Sanitation Foundation) marking. Manufacturer shall also mark the date of extrusion on the pipe.

PVC Fabricated Fittings: AWWA C900, Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

Fittings shall be injection-molded of an improved PVC compound. Fittings shall conform to ASTM D 1784, Cell Classification 12454-B.

Tees and ells shall be side gated.

Fittings shall bear the company's name and trademark, material designation, size, applicable iron pipe size (ips) schedule, and NSF seal.

Threaded nipples shall be standard weight Schedule 80 with molded threads.

2.2 VALVES

2.2.1 Gate Valves

Valves shall be designed for a minimum of 150 psi. Valves shall have bell-and-spigot ends. Valves shall have a clear waterway equal to the full nominal diameter of the valve, and shall be opened by turning counterclockwise. Operating nut or wheel shall have an arrow cast in the metal indicating the direction of opening. Valves smaller than 3 inches shall be all bronze and shall conform to MSS SP-80, Type I. Valves 3 inches and larger shall be iron-body, brass-mounted, conforming to AWWA C500.

2.3 MISCELLANEOUS ITEMS

2.3.1 Tapped Tees

Tees shall be installed as necessary.

2.3.2 Corporation Stops

Corporation stops shall have waterworks standard thread on the inlet end, with flanged-joint couplings or wiped joints for connections to goosenecks.

2.3.3 Service Stops

Service stops shall be waterworks ground-key type, oval flow way, tee handle, without drain. Pipe connections shall be suitable for the type of service pipe used. Parts shall be cast red brass having a nominal composition of 85-percent copper, 5-percent tin, 5-percent lead, and 5-percent zinc, with female (ips) connections designed for a minimum pressure of 200 psi.

2.3.4 Service Boxes

Service boxes shall be cast iron. Extension service boxes of the required length, having either screw or slide adjustment, shall be installed at service-box locations. Boxes shall have housings of sufficient size to completely cover the service stop and shall be complete with identifying covers. Where water mains are located in streets having curbs, boxes shall be located directly back of the curbs. Where no curbing exists, boxes shall be in accessible locations beyond the limits of streets, walks, and driveways.

2.3.5 Valve Boxes

Valve boxes shall be cast iron, complete with lock-type covers requiring a special wrench for removal. Cast-iron boxes shall be the extension type with screw or slide adjustments and with flared bases. Concrete boxes shall be constructed in accordance with details indicated. The word "WATER" shall be cast in the cover. Boxes shall be installed over each gate valve. Boxes shall be of such a length as can be adapted, without full extension, to the depth of cover required over the pipe at the valve location. Concrete boxes may be installed only in locations not subjected to traffic.

2.4 CONCRETE

Concrete for thrust blocks shall be a minimum of 3,000 psi.

PART 3 EXECUTION

3.1 PIPE HANDLING

Pipe and accessories shall be handled in a manner to ensure delivery to the trench in an undamaged condition. Particular care shall be taken not to injure the pipe coating. When the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor at his expense in an approved manner. No other pipe or material shall be placed inside of a pipe or fitting after the coating has been applied. Pipe shall be carried into position. Use of pinch bars and tongs for aligning or turning the pipe shall be permitted only on the bare ends of the pipe. Interior of pipe and accessories shall be cleaned before being lowered into the trench and shall be kept clean during laying operations by an approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional cost to the Government. Rubber Gaskets that are not to be installed immediately shall be stored in a cool dark place out of the direct rays of the sun.

3.2 CUTTING OF PIPE

Cutting of pipe shall be done without damage to the pipe. Cutting shall be done with an approved mechanical cutter. Wheel cutters shall be used when practical.

3.3 LOCATION

Where the location of the water pipe is not clearly defined by dimensions, the water pipe shall be laid not closer than 10 feet from a sewer horizontally, except where the bottom of the water pipe will be at least 18 inches above the top of the sewer pipe, in which case the water pipe shall be laid not closer than 6 feet from the sewer horizontally. Where waterlines cross under gravity flow sewer lines, the sewer pipe for a distance of at least 10 feet each side of the crossing shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 3 feet, horizontally, of the crossing. Waterlines shall, in all cases, cross above sewage force mains or inverted siphons and shall be not less than 2 feet above the sewer main. Joints in the sewer main closer horizontally than 3 feet, to the crossing shall be encased in concrete. Waterlines shall not be laid in the same trench with gas lines, fuel lines, or electrical wiring.

3.4 DEFLECTION

Maximum allowable deflections from a straight line or grade, as required by vertical curves, horizontal curves, or offsets, shall be 5 degrees for cement or reinforced-concrete pipe. Maximum allowable deflection for cast-iron bell-and-spigot pipe and mechanical-joint pipe, shall be as recommended by the manufacturer.

When the alignment requires deflections in excess of the manufacturer's recommendations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth, as approved. Long-radius curves in reinforced-concrete pipe shall be formed by straight pipe in which spigot rings are placed on a bevel. Slight deflections may be made by straight pipe, provided that the maximum joint opening caused by such deflections does not exceed the maximum recommended by the pipe manufacturer. Short-radius curves and closures shall be formed by shorter lengths of pipe, bevels, or fabricated special sections.

Where PVC and ductile iron pipe is used, a single conductor No. 14 AWG wire with Type TW insulation shall be installed 18 inches below grade in same trench to facilitate pipe location.

3.5 PLACING, LAYING AND PIPE CONNECTIONS

Pipe and accessories shall be carefully lowered into the trench by suitable equipment. Under no circumstances shall materials be dropped or dumped into the trench. Care shall be taken to avoid abrasion of the pipe coating. Poles used as levers for removing skids across trenches shall be made of wood and have broad flat faces to prevent damage to the pipe or

coating. Except where necessary in making connections with other lines or as authorized, pipe shall be laid with the bells facing upstream. Full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid.

Pipe shall not be laid in water or when trench conditions are unsuitable for the work. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that foreign material will not enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by the Contractor in an approved manner, at no additional expense to the Government.

Pipe ends left for future connections shall be valved, plugged, or capped and anchored. Where connections are made between new work and existing mains, the connections shall be made by using special sections and fittings to suit the actual conditions. Where made under pressure, connections shall be installed in accordance with the recommendations of the manufacturer of the pipe being tapped.

3.6 RUBBER GASKETS

Rubber gaskets shall be handled, lubricated, and installed in accordance with the pipe manufacturer's recommendations. Outside annular space between abutting sections of concrete pipe shall be filled with cement mortar. When recommended by the manufacturer, the inside annular joint space shall be filled with cement mortar after backfilling has been partially accomplished.

3.7 COUPLINGS AND JOINTS

Joints for Copper Tubing shall be compression pattern, flared, for soft copper water tubing and shall be made of approved fittings. Tubing shall be cut off square and expanded with an acceptable flaring tool. Installation of couplings and mechanical joints shall be in accordance with the manufacturer's recommendations. Pipe Connections between different types of pipe and accessories shall be made with transition fittings as recommended by the manufacturer.

3.8 SERVICE LINES

Service lines shall include the lines to and connections with, the building service at a point 5 feet outside the building. Service Stops and Gate Valves shall be provided with extension boxes of the lengths required by the depths of service line stops or valves. Service lines shall be constructed in accordance with the following: service lines 1-1/2 inches and smaller shall be connected to the main by a Corporation-Type Stops and a copper gooseneck, with a service stop below the frostline. Two-inch service lines shall be connected to the main with a rigid connection or a corporation-type stop and copper gooseneck and a gate valve located below the frostline. Where two or more gooseneck connections to the main are required for an individual service, such connections shall be made with standard quality branch connections in conformance with recognized standard practice. The total clear area of the branches shall be at least equal to the clear area of the service which they are to supply. Service lines

larger than 2 inches shall be connected to the main by a rigid connection and shall have a gate valve located below the frostline.

3.9 VALVES AND VALVE BOXES

Valves shall have the interiors cleaned of all foreign matter before installation. Each hydrant shall be connected to the main with a 6-inch branch line having at least as much cover as the distribution main. Valves and valve boxes shall be set plumb. Valve boxes shall be centered on the valves. Valves shall be located outside the area of sidewalks, roads, streets, and parking areas. Earth fill shall be carefully tamped around each valve box to a distance of 4 feet on all sides of the box. Stuffing boxes shall be tightened, and the hydrants and valves shall be inspected in open and closed positions to ensure that all parts are in working condition.

3.10 THRUST BLOCKS

Plugs, caps, tees, bends deflecting 22-1/2 degrees or more on mains 8 inches in diameter or larger, and fire hydrants shall be provided with concrete thrust blocks. Blocks shall be placed between solid ground and the hydrant or fitting to be anchored. Blocks shall be so placed that fitting joints will be accessible for repair.

Megalug, mechanical joint restraint may be used on ductile iron or AWWA C900 pipe in-lieu-of thrust blocks.

3.11 TESTING

3.11.1 Hydrostatic Test

Hydrostatic-pressure test shall be made no sooner than 72 hours after installation of thrust blocks.

3.11.2 Pressure Test

After the pipe is laid, the joints completed, the fire hydrants permanently installed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall be subjected for 1 hour to a hydrostatic-pressure test of 150 psi. Mains supplying water to individual buildings for fire protection shall be subjected for 2 hours to a hydrostatic-pressure test of 200 psi. Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, valves, and hydrants shall be carefully examined during the open-trench test. Joints showing visible leakage shall be replaced or remade as necessary. Leaking rubber gasketed joints shall be remade using new gaskets when necessary. Pipe, mechanical joints, fittings, valves, or hydrants discovered to be cracked or defective as a consequence of this pressure test shall be removed and replaced with sound material, and the test shall be repeated until the test results are approved.

3.11.3 Leakage Test

Leakage tests shall be conducted after the pressure test has been approved.

Duration of each leakage test shall be at least 2 hours. During the test, the main shall be subjected to a pressure of 200 psi. Leakage is defined as the additional quantity of water supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

Allowable leakage in gallons per hour per joint at 200 psi average test pressure shall be as follows:

<u>PIPE DIAMETER</u> <u>(INCHES)</u>	<u>ALLOWABLE LEAKAGE</u> <u>(GALLONS PER HOUR)</u>
2	0.0153
3	0.0230
4	0.0306
6	0.0458
8	0.0610
10	0.0765
12	0.0915
14	0.1070
16	0.1225
18	0.1375
20	0.1530
24	0.1830

Allowable leakage in gallons per hour not exceed 5 percent of total system pressure.

Should any test of laid pipe disclose a leakage greater than that shown, the defective joints shall be located and repaired until the leakage is within the specified tolerance, at no additional cost to the Government.

3.11.4 Test Timing

Except where concrete-reaction backing necessitates a 72-hour delay, pipelines jointed with rubber gaskets, mechanical, or bolted joints may be subjected to hydrostatic pressure, inspected, and tested for leakage after partial completion of backfill.

3.11.5 Retesting

Before permanent paving is placed over the pipeline, a measured leakage

test of the entire pipeline shall be required. Leakage loss shall be within approved tolerances.

3.11.6 Sterilizing

Water piping, including valves, fittings, and other devices, shall be sterilized and tested according to AWWA C651. After successful sterilization, the piping shall be flushed before placing into service. Water for sterilization will be furnished by the Government, but disposal shall be the responsibility of the Contractor.

3.12 PROTECTIVE COATING

Exposed portions of steel joint rings of reinforced-concrete pipe shall be protected from corrosion by a metallic coating, or by a nonmetallic coating when approved.

-- End of Section --

SECTION 02536

SANITARY SEWERAGE SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ASTM INTERNATIONAL (ASTM)

ASTM D 3034	(2000) Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
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1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Records of Existing Conditions shall be submitted by the Contractor prior to construction.

SD-02 Shop Drawings

The following shall be submitted by the Contractor in accordance with paragraph entitled, "Drawings," of this section.

As-Built Drawings

SD-06 Test Reports

Reports for the following shall be submitted in accordance with paragraph entitled, "Reports," of this section.

Test Reports
Inspection Reports

SD-07 Certificates

Certificates of compliance for the following items shall be submitted in accordance with the applicable reference standards and description of this section:

Concrete Aggregates
Portland Cement
Rubber Gaskets
Pipe

Frames and Covers

1.3 DRAWINGS

Installation Drawings shall be submitted showing complete detail, both plan and sideview details with proper layout dimension and elevations.

As-Built Drawings for the complete sanitary sewer system shall be submitted showing complete detail with all dimensions, both above and below grade.

1.4 EXISTING CONDITIONS

Existing Conditions shall be submitted after a thorough inspection of the area by the Contractor in the presence of the Contracting Officer. Details should include the condition of environment and other areas adjacent to site work. Copies of the record shall be submitted and the stated conditions before starting work shall be verified.

PART 2 PRODUCTS

2.1 CONCRETE AGGREGATES

Aggregates shall conform to ASTM C 33.

2.2 RUBBER GASKETS

Rubber gaskets shall conform to ASTM C 443, ASTM C 564, and ASTM D 1869.

2.3 PIPE

Pipe shall be as follows:

Polyvinylchloride (PVC) pipe and fittings shall conform to ASTM D 3034, Cell Classification 12454-B.

2.4 PORTLAND CEMENT

Cement shall conform to ASTM C 150.

2.5 FRAMES AND COVERS

Cast iron frames and covers shall be in accordance with AASHTO M 306.

Deviations in standard castings shall be acceptable only when prior approval has been granted. Frames and covers shall have a combined weight of not less than 400 pounds and shall conform to ASTM A 48/A 48M.

The letter S at least 2 inches high shall be stamped or cast into covers so as to be conspicuously visible.

2.6 JOINTING

Cement mortar shall not be used as a pipe-jointing material except for wye branches.

Pipe joints shall be sealed with:

Factory molded plastic in the annular space and on the spigot of the pipe.

A rubber gasket configuration, as recommended by the pipe manufacturer for the particular type of pipe joint. Gaskets shall be installed to provide a tight fit. Rubber gaskets may be used with PVC pipe.

2.7 MANHOLES

2.7.1 Construction

Manholes shall be constructed of concrete, reinforced precast-concrete rings, precast-concrete rings, or precast-concrete segmental blocks, with cast iron frames and covers. Frames and covers shall be bolted down and as necessary. Frames and covers shall be set so that the top of the cover is 4-inches higher than finished grade, where no pavement exists. Where pavement does exist, frames shall be flush with surface. Invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly.

2.7.1.1 Invert Channels

Invert channels shall be formed directly in the concrete of the manhole base. Flooring of the manhole outside the channels shall be smooth and shall slope toward the channels, no less than 1 inch per foot nor more than 2 inches per foot. The free drop inside the manholes shall not exceed 1 foot 6 inches measured from the invert of the inlet pipe to the top of the floor of the manhole outside the channels. Drop manholes shall be constructed whenever the free drop would be greater than 1 foot 6 inches.

2.7.1.2 Concrete

Concrete used in manholes shall have a compressive strength of not less than 3,000 pounds per square inch after 28 calendar days and shall be composed of not less than six 7-1/2 bags of portland cement per cubic yard. Coarse aggregate shall be used in the greatest amount consistent with required workability. The foregoing requirements apply to concrete in precast rings, segmental blocks, and concrete poured in place. Concrete rings shall conform to ASTM C 76, except that the length of sections may be shorter as conditions require. Wall thicknesses shall be not less than 4 inches nor less than 1/12 the diameter of the manhole for either vertical walls or cone sections and shall be reinforced with not less than 0.12 square inch of steel per foot of height. Joints between precast rings shall be full-bedded in cement mortar and shall be smoothed to a uniform surface on both the interior and exterior of the manhole. Segmental blocks shall be at least 5 inches but not more than 8 inches in thickness, not less than 8 inches in length, and of a shape that the joints can be effectively sealed and bonded with cement mortar.

2.7.1.3 Ladders

When the depth from the top of the cover to the invert of the main sewer exceeds 6 feet, manholes shall be provided with a straight steel ladder not less than 16 inches in width with 3/4-inch diameter rungs spaced 12 inches on center. Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 6 feet apart vertically and installed to provide at least 6-1/2 inches of toe space between the wall and the inside of the rungs. Stringers shall be 1/2- by 1-1/2-inch steel bars. Ladder and inserts shall be galvanized after fabrication in accordance with ASTM A 123/A 123M. Wall along the line of the ladder shall be vertical its entire height.

2.8 REPORTS

Test Reports shall be submitted. Compaction and density test shall be in accordance with Section 02312 EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES.

Inspection Reports for daily activities during the installation of the sanitary system shall be submitted. Information in the report shall be detailed enough to describe location of work and amount (footage) laid.

PART 3 EXECUTION

3.1 LOCATION

Where the location of the sewer is not clearly defined by dimensions, the sewer shall be laid not closer than 10 feet horizontally to a water supply main or service line, except that where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, the horizontal spacing shall be a minimum of 6 feet. Water lines shall be above sewage force mains.

Where gravity-flow sewers cross above waterlines, the sewer pipe for a distance of at least 10 feet each side of the crossing shall be cast iron, steel, or other acceptable pressure pipe and without joints closer horizontally than 3 feet to the crossing, or the sewer pipe shall be fully encased in concrete. Thickness of the concrete, including that at the pipe joints, shall be not less than 4 inches.

3.2 PIPE LAYING

Bottom of trench shall be shaped to give uniform circumferential support to the lower fourth of each pipe. Pipe laying shall proceed upgrade with the spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow. Each pipe shall be laid true to line and grade in a manner to form a close concentric joint with the adjoining pipe and prevent sudden offsets of the flow line. Interior of the sewer shall be cleared of superfluous materials at all times. Where cleaning after laying is difficult, a suitable swab or drag shall be kept in the pipe and pulled forward past each joint immediately after jointing has been completed. When the maximum width of the trench at the top of the

pipe is exceeded for any reason other than by direction, the Contractor shall install, at no additional cost to the Government, such bedding as may be required to satisfactorily support the added load of the backfill. Trenches shall be kept free from water until the pipe-joining material has set. Pipe shall not be laid when the condition of the trench or the weather is unsuitable for such work. When work is not in progress, open ends of pipe and fittings shall be closed to prevent intrusion of foreign materials.

3.3 INFILTRATION AND EXFILTRATION

Leakage shall not exceed a rate of 200 gallons per inch of pipe diameter per mile per day of sewer for any section between successive manholes. When infiltration appears excessive, the amount of leakage shall be measured by a suitable weir or other device. When the determination of infiltration is not practicable because of dry trench conditions, exfiltration tests shall be made by filling the sewer between successive manholes with water to the top of the outlet of the upper manholes. Amount of water required to maintain the pipe full for the required test period shall be measured and the rate of leakage determined. When leakage exceeds the maximum amount, an approved correction shall be made. Both measurement and correction shall be made at no additional cost to the Government.

3.4 WYE BRANCHES

Commercially manufactured wye branches shall be installed where sewer connections are necessary. Cutting into pipe for connections shall not be done except as approved. When conditions are such that the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, the pipe shall be encased in concrete or supported on a concrete cradle as directed. Concrete required due to faulty construction methods or negligence of the Contractor shall be installed at no additional cost to the Government.

3.5 CONNECTIONS TO EXISTING MANHOLES

Pipe connections to existing manholes shall be made in such manner that the finished work shall conform as nearly as practicable to the applicable requirements for new manholes.

3.6 ACCEPTANCE

Sections of the sewer found defective in material, alignment, grade, or joints shall be corrected at no additional cost to the Government before acceptance.

-- End of Section --

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SECTION 02555

GAS DISTRIBUTION SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Related Sections

Excavation and backfill are specified in Section 02312 EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES.

1.1.2 System Description

Lines shall include lines to, and connections with, the building service at a point approximately 5-feet outside the building and shall be plastic pipe. Where building services are not installed, the Contractor shall terminate the service lines approximately 5-feet from the site of the proposed building at a point designated by the Contracting Officer. Such service lines shall be closed with plugs or caps.

1.2 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

AGA Manual (1994) Plastic Pipe Manual for Gas Service

ASTM INTERNATIONAL (ASTM)

ASTM D 2513 (1995) Thermoplastic Gas Pressure Pipe, Tubing, and Fittings

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

The following drawings shall be submitted in accordance with paragraph entitled, "Drawings," of this section.

Installation Drawings

SD-03 Product Data

Manufacturer's Catalog Data shall be submitted for the following items:

Plastic Pipe and Fittings
Protective Systems

SD-06 Test Reports

Test reports shall be submitted for operational tests on gas distribution systems in accordance with the paragraph entitled, "Tests," of this section.

Inspection Reports shall be submitted in accordance with the paragraph entitled, "Inspection," of this section.

Records of Quality Control shall be maintained in accordance with the paragraph entitled, "Quality Control," of this section.

SD-08 Manufacturer's Instructions

The following shall be submitted in accordance with the paragraph entitled, "Instructions," of this section.

Manufacturer's Instructions
Posted Instructions

1.4 QUALITY ASSURANCE

Materials and equipment shall be the products of manufacturers regularly engaged in the manufacture of such products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to the bid opening.

1.5 HANDLING

During shipping, delivery, and installation, pipe and accessories shall be handled in a manner that will ensure a sound, undamaged condition. Particular care shall be taken not to injure pipe coating. Pipe or materials shall not be placed inside another pipe or fitting after the coating has been applied, except as specified. Coated and wrapped steel pipe shall be handled in conformance with AWWA C203.

Plastic pipe shall be handled in conformance with ASME B31.4 and ASTM D 2517 and AGA Manual.

1.6 DRAWINGS

Installation Drawings shall be submitted for gas distribution systems in accordance with the manufacturer's recommended instructions.

1.7 QUALITY CONTROL

Contractor shall establish and maintain records of quality control. A copy of records of inspections and tests shall be furnished.

1.8 INSTRUCTIONS

Manufacturer's Instructions shall be submitted for gas distribution systems including special provisions required to install equipment components and system packages. Special notices shall detail impedances, hazards and safety precautions.

PART 2 PRODUCTS

2.1 VALVES

Valves shall be suitable for shutoff or isolation service.

2.1.1 1-1/2 Inches or Smaller

Valves 1-1/2 inches or smaller installed underground shall conform to MSS SP-86 and MSS SP-84, carbon steel, socket weld ends, with square wrench operator adaptor.

2.1.2 Sealing Compound

Joint Sealing compound shall be as listed in UL 6, Class 20 or less.

2.1.3 Tape

Tetrafluoroethylene tape shall conform to PPI TN2, ASTM D 3139.

2.2 VALVES, PLASTIC PIPE AND FITTINGS

2.2.1 Polyethylene

Pipe shall conform to ASTM D 1248 and ASTM D 2513, Pipe Designations PE 2306, PE 2406 and PE 3306, designed for gas distribution.

2.2.2 Thermoplastic Valves

Thermoplastic valves for underground installation only, shall conform to ASME B16.40.

2.2.3 Steel Valves in Plastic Lines

Valve installation in plastic lines shall be designed to protect the plastic pipe against excessive torsional or shearing loads when the valve is operated and from any other stresses which may be exerted through the valve or valve box.

2.3 CATHODIC PROTECTION

Cathodic protection shall conform to the requirements of Section 13110 cathodic protection.

PART 3 EXECUTION

3.1 DISTRIBUTION SYSTEM

Materials and equipment shall be installed in accordance with the recommendations of the manufacturer.

Gas distribution system shall be installed in conformance with ASTM F 1376, MSS SP-86 and ASME B31.8.

3.2 SERVICE LINES

Service lines shall be connected to gas mains as indicated. Service lines shall be provided with shutoff plug valves of the same sizes as the service lines, where indicated. Plug valve shall be located near the supply main but at a safe distance from traffic lanes. Service lines shall be as short and straight as practicable between the building and gas main and shall not be bent or curved laterally, except to avoid obstructions or as otherwise directed. Steel pipe and fittings shall be covered with protective covering as specified. Service lines shall be laid with as few joints as feasible using standard lengths of pipe. Shorter lengths shall be used only for closures. Limitations on the use of plastic pipe shall be as specified.

3.3 INSTALLING UNDERGROUND PIPE

Gas mains and service lines shall be graded as indicated. Joints in steel pipe shall be welded, except as permitted for installation of valves. Mains shall have a minimum cover of 24 inches, and service lines shall have a minimum cover of 18 inches, laid on firm soil for the full length. Where the trench has been excavated below grade, the trench shall be backfilled with suitable material and tamped to provide full-length bearing. Laying pipe on blocks to produce a uniform grade will not be permitted. Pipe shall be clean inside before it is lowered into trench and shall be maintained free of water, soil, and other foreign matter that might injure or obstruct operation of valves, regulators, burners, or other equipment. When work is not in progress, open ends of pipe or fittings shall be securely closed by expandable plugs or other approved means.

A single conductor No. 14 AWG wire with type TW insulation shall be installed with plastic pipe to facilitate the pipe location.

The pipe shall be identified with a 4 inch wide metal foil locator tape buried 12 inches below grade.

Minor changes in line or gradient of steel pipe that can be accomplished through flexibility of the pipe without producing permanent deformation and overstressing the joints may be made when approved. Changes in line or gradient that exceed the bend limitations specified shall be made with suitable fittings. Where indicated at crossings of gas mains under traffic lanes or railroads, pipe shall be laid inside a casing of standard weight black steel pipe provided with protective coating as specified. Vents and sealing of the casing shall be provided as indicated. Vents shall be provided with a copper or aluminum function-identification plate.

3.4 JOINTING

3.4.1 Joints in Plastic Pipe

Polyethylene joints shall be made by heat fusion with socket fittings in conformance with ASME B31.4 and ASTM D 2517 and AGA Manual.

3.5 PIPE CUTTING

Cutting shall be done without damage to the pipe. Unless otherwise authorized, cutting shall be done by means of an approved type of mechanical cutter. Wheel cutters shall be used where practical.

3.6 DRIPS

Drips shall be installed at locations where indicated. Drips shall conform to the details indicated or may be of commercial manufacture approved as to type and capacity. A blowoff pipe, 1-1/4 inches or larger, shall be connected to each drip at its lowest point and shall extend to or near the ground surface at a convenient location outside of traffic. A discharge terminal shall be provided with a reducing fitting, plug valve, and 1/2-inch nipple turned down. Discharge terminal shall be inside a length of 12 inch or larger vitrified-clay pipe or concrete sewer pipe set vertically on a bed of coarse gravel 1-foot thick and 3-feet square, closed at the ground surface with a replacement cover.

3.7 CONNECTIONS TO EXISTING LINES

Connections between new work and existing gas lines, where required, shall be approved, using proper specials and fittings to suit the actual conditions in accordance with ASTM F 1376, MSS SP-86 and ASME B31.8. When connections are made by tapping into a gas main, the connecting fitting shall be the same size as the pipe to be connected.

3.8 INSPECTION

Inspection Reports shall be submitted identifying activity by contract number, location, craft discipline, quantity of material placed, and timed events or milestones.

3.9 TESTS

Contractor shall prove that the entire system of gas mains and service lines included in the contract is gastight by an air test under a pressure of 45 psig 310.3 kilopascal or not less than 50 percent more than the operating pressure, whichever is greater.

3.9.1 Test of Gas Mains

Tests shall be made on the system as a whole or on the sections that can be closed off by the valves indicated. Smaller sections may be tested when backfilling the trenches in such sections, in advance of the completion of other sections, if essential. Test shall continue for at least 24 hours between the times of the initial and final readings of pressure and temperature. Initial test readings of the instruments shall not be made for at least 1 hour after the pipe has been subjected to the test pressure, and neither the initial nor final readings shall be made at times of rapid

changes in atmospheric conditions. Temperatures shall be representative of the actual trench conditions. There shall be no indication of reduction of pressure during the test after corrections have been made for changes in atmospheric conditions in conformity with the relationship $T_1P_2=T_2P_1$, in which T and P denote absolute temperature and pressure, respectively, and the numerals denote initial and final readings. During the test, the entire system shall be completely isolated from sources of air pressure. Testing instruments shall be approved and shall be subject to inspection at all times during the test. If so required, the test shall be made with instruments supplied by the Government.

3.9.2 Test of Service Lines

Service lines shall be tested with the gas mains or may be tested separately with soapsuds applied at the pipe joints.

-- End of Section --

SECTION 02635

STORM SEWERAGE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ASTM INTERNATIONAL (ASTM)

ASTM C 478	(1995) Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 923	(1994) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM D 2321	(1989) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 3034	(1994) Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1992) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F 1417	(1992) Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low Pressure Air
ASTM F 477	(1995) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS RR-F-621	(Rev E) Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole
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1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Coordination Drawings in accordance with paragraph entitled, "Drawings," of this section.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following:

- Frames, Covers and Gratings
- Precast Concrete Manholes
- Precast Concrete Base Sections
- Concrete Block
- Bituminous Coating
- Cold Bituminous Mastic Sealer

SD-06 Test Reports

Test reports shall be submitted in accordance with paragraph entitled, "Tests," of this section.

- Infiltration Test
- Exfiltration Test
- Hydrostatic Test

1.3 BEDDING AND BACKFILL

Bedding and backfill shall conform to Section 02225 EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES.

1.4 PLANS

A Work Plan shall be submitted when sewer flow is to be interrupted, noting Proposed Schedules, Methods, Materials and Equipment.

PART 2 PRODUCTS

2.1 BONDING AND SEALING MATERIALS

2.1.1 Bituminous Coating and Sealing

Coating shall be in accordance with ASTM A 849.

Coating shall be in accordance with ASTM A 849, when using materials previously coal-tar coated and for each uncoated ferrous piece used underground.

Cold Bituminous Mastic Sealer shall be in accordance with ASTM A 849 trowel consistency.

2.1.2 Epoxy Bonding

Epoxy adhesive shall be in accordance with AWWA C210.

2.2 CONDUIT PIPING, JOINTS, FITTINGS AND GASKETS

2.2.1 Plastic Piping

2.2.1.1 Type PSM Poly(Vinyl Chloride) (PVC) Pipe

Pipe shall be in accordance with ASTM D 3034, SDR 35, up to 15 inch diameter.

Pipe ends made for joints shall be elastomeric gasket type.

2.2.1.2 PVC Pipe Joints

Joints shall be in accordance with ASTM D 3212, push-on type.

Gaskets shall be in accordance with ASTM F 477.

2.3 FRAMES, COVERS AND GRATINGS

Manhole, catch-basin, and sump frames, covers, and gratings shall be in accordance with FS RR-F-621.

Cast iron materials shall be provided. The following legends shall be cast-in on every cover: STORM. Cast iron shall conform to ASTM A 48, Class 30B, minimum.

2.3.1 Manhole Frames , Covers, and Gratings

Frames shall be Type I, Style A, Size 24 inches.

Covers shall be Type A, Size 24 inches.

Gratings shall be Type F, Style 1, Size 24 inches.

2.3.2 Catch-Basin Frames and Gratings

Frames shall be Type VI , Size 24 inches.

Gratings shall be Type G, Style 1, Size 24 inches.

2.3.3 Sump Frame and Grating

Frame shall be Type VII.

Grating shall be Type I.

2.4 PRECAST CONCRETE MANHOLES, RISERS AND PRECAST CONCRETE BASE SECTIONS

Concrete manholes, risers, base sections, and tops shall be pre-cast and conform to ASTM C 478.

Precast parts shall contain wire fabric reinforcement.

Acceptability for tops shall be based upon proof of design testing.

2.4.1 Manhole Gaskets

Gaskets shall be in accordance with ASTM C 443 for joints between manhole sections.

2.4.2 Manhole Connectors

Connectors shall be in accordance with ASTM C 923 for joints between manhole and pipes.

2.5 MANHOLE AND CATCH-BASIN ACCESS LADDER

Access shall be in accordance with ASTM C 478, using ladders for manholes or catch basins at least four feet deep.

PART 3 EXECUTION

3.1 EXCAVATION AND BACKFILL

Excavation, backfill, and removal of unsatisfactory materials shall be in accordance with Section 02312 EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES.

3.2 GRADING

Grading shall be performed in accordance with Section 02315 EXCAVATION AND FILL.

3.3 PIPE INSTALLATION

3.3.1 Pipe Installation

Excavations shall be trimmed to required elevations. Objects which impair backfilling or compaction shall be removed. Over-excavation shall be corrected with fill material of coarse aggregate.

Pipe and fittings shall be inspected for defects before installing. Defective materials shall be removed from site.

Pipe interior shall be cleaned before installation. Pipe ends shall be sealed when work is not in progress.

Pipe shall be laid to line and grade, with bell end upstream.

Maximum variation from true slope shall not exceed 1/8 inch in 10 feet.

Corrections shall be made at a rate not to exceed 0.10 foot for one length of conduit.

3.3.2 PVC Plastic Pipe Installation

PVC pipe and fittings shall be installed in accordance with manufacturer's instructions and in accordance with ASTM D 2321.

3.4 PIPE BEDDING

3.4.1 Bedding

Minimum compacted bedding under installed pipe shall be one-fourth of the pipe diameter in thickness, and in no case less than 4 inches or more than 12 inches.

Bedding shall be placed in layers not exceeding 6 inches in depth and compacted. Additional layers shall be added until a minimum elevation of 12 inches above the pipe is achieved.

3.4.2 Compaction

Puddling or jetting shall not be permitted when compacting bedding materials.

3.5 UNDERGROUND STRUCTURES

3.5.1 Structures

1/2 inch thick ASTM C 387, Type M mortar shall be applied to both interior and exterior surfaces.

Top of manhole and catch basin covers shall be set flush with finished pavement surfaces. Elsewhere, tops shall be set 3 inches above finished surface.

Attach steps into manhole walls with epoxy compound.

Preformed bituminous expansion joint material shall be provided 3/4 inch thickness around drainage structures in pavements.

Joints for concrete risers and tops shall be made with flexible watertight rubber-type gaskets.

Catch basins and curb drop inlets shall be constructed.

3.5.2 Concrete Construction

Concrete shall be in accordance with Section 03305 CAST-IN-PLACE CONCRETE.

3.5.3 Invert Channel Installation

Invert channels shall be smooth and fitted to each inlet, outlet, or transition for correct hydraulic flow.

3.6 STORM SEWER CONNECTIONS AND WYES

Pipe connections to existing conduit and manholes shall be provided.

Wyes for branch connections shall be provided. Field-cutting into conduit shall not be permitted. Wyes shall be sprung into existing lines. Entire wye shall be encased in concrete.

Epoxy shall be used to secure each interface connecting new and existing conduit.

3.7 FIELD QUALITY CONTROL

3.7.1 Tests

Contractor shall provide test equipment or engage the services of a firm to provide the necessary testing.

3.7.1.1 Infiltration Test/Exfiltration Test

Infiltration and exfiltration tests for installed concrete pipe shall be performed in accordance with ASTM C 969.

3.7.1.2 Hydrostatic Test on Watertight Joints

Hydrostatic tests shall be upon one sample for each type of joint to be installed. When the sample joint fails, an additional joint of the same type shall be re-tested.

Joints shall be protected from temperatures which adversely affect the joining materials.

Hydrostatic Pressure tests shall be performed at a pressure of 10 pounds per square inch (psi) for 24 hours.

3.7.1.3 Low Pressure Air Test of Conduit

Acceptance tests for installed ferrous and plastic piping shall be in accordance with ASTM F 1417.

3.7.2 Interior Inspection of Pipe

Installed pipe shall be inspected when 2 feet of earth cover is in place. Displaced or misaligned pipe, infiltration, accumulation of debris, or other defects shall be corrected by the Contractor at no additional cost to the Government.

-- End of Section --

SECTION 02745

ASPHALTIC CONCRETE PAVING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 145	(1991; R 2003) Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
AASHTO M 247	(2002) Glass Beads Used in Traffic Paints
AASHTO M 248	(1991; R 2000) Ready-Mixed White and Yellow Traffic Paints
AASHTO T 166	(2000) Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens
AASHTO T 180	(2001) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

ASPHALT INSTITUTE (AI)

AI MS-02	(1997; 6th Ed) Mix Design Methods for Asphalt
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ASTM INTERNATIONAL (ASTM)

ASTM C 127	(2001) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C 128	(2001e1) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
ASTM D 1073	(2001) Standard Specification for Fine Aggregate for Bituminous Paving Mixtures
ASTM D 1556	(2000) Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 2027	(1997; R 2004) Standard Specification for Cutback Asphalt (Medium-Curing Type)
ASTM D 2041	(2003a) Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D 2216	(1998) Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 242	(1995; R 2000; E 2001) Standard Specification for Mineral Filler for Bituminous Paving Mixtures
ASTM D 2922	(2001) Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3282	(1993; R 1997e1) Standard Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
ASTM D 5581	(1996; R 2001) Standard Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus (6 Inch-Diameter Specimen)
ASTM D 692	(2000) Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures
ASTM D 70	(2003) Standard Test Method for Density of Semi-Solid Bituminous Materials (Pycnometer Method)
ASTM D 854	(2002) Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer
ASTM E 11	(2001) Standard Specification for Wire-Cloth and Sieves for Testing Purposes

U.S. DEPARTMENT OF TRANSPORTATION (DOT)

DOT	(2000; R1) Federal Highway Administration Publication: Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways
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1.2 DEFINITIONS

Conform to AASHTO M 145, for satisfactory soil materials, (ASTM D 3282) Soil Classification Groups A-1, A-2-4, A-2-5, and A-3.

Conform to AASHTO M 145, for unsatisfactory soil materials, Soil

Classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7, peat and other highly organic soil, and soil materials of any classification that have a moisture content at the time of compaction outside the range required to achieve the field dry unit weight as specified.

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-03 Product Data

Submit manufacturer's catalog data for bituminous concrete showing description, mixing, and application instructions for the following items:

- Asphalt Cement
- Bituminous Concrete
- Bituminous Prime Coat
- Bituminous Tack Coat
- Paint
- Reflective Beads
- Subbase and Base Course

SD-05 Design Data

Submit a Job-Mix Formula for bituminous concrete in accordance with paragraph entitled, "Job-Mix Formulas," of this section.

SD-06 Test Reports

Submit a test report in accordance with the paragraph entitled, "Quality Control Testing During Construction," of this section.

SD-07 Certificates

Submit certificates for the following items and meet the performance requirements of the paragraph entitled, "Performance Requirements," and applicable standards contained within this section.

- Asphalt Cement
- Bituminous Concrete
- Bituminous Prime Coat
- Bituminous Tack Coat
- Paint
- Reflective Beads
- Subbase and Base Course

1.4 PROTECTION OF PERSONS AND PROPERTY

Conduct paving operations in a manner that will ensure the safety of persons and property.

1.5 MAINTAINING TRAFFIC

Barricade traffic lanes and detour routes and post with warning signs for safety and directing traffic. Provide warning lights during hours of darkness, in accordance with DOT.

1.6 SAMPLING AND TESTING

1.6.1 Testing and Inspection

The Contractor must provide testing facilities for quality control during construction of bituminous-concrete courses.

1.6.2 Test for Bituminous Concrete Mixture

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Compacted bituminous-concrete mix	Bulk density	AASHTO T 166	One for each bituminous-concrete mixture
	Marshall Stability Test	ASTM D 5581	
Aggregate and asphalt cement	Specific gravity of coarse aggregate	ASTM C 127	One for each material
	Specific gravity of fine aggregate	ASTM C 128	
	Apparent specific gravity of mineral filler	ASTM D 854	
	Apparent specific gravity of asphalt cement	ASTM D 70	
Uncompacted bituminous-concrete mix	Maximum theoretical specific gravity	ASTM D 2041	One for each bituminous-concrete mixture

Calculate a density and voids analysis for each series of bituminous-concrete mixture test specimens in conformance with AI MS-02. Include the quantity of absorbed asphalt cement in pounds of dry aggregate, percent of air voids, and percent of voids in mineral aggregate.

Submit a report of each job-mix formula on the form entitled, "Hot-Mix Design Data by the Marshall Method" as shown in AI MS-02.

1.6.3 Quality Control Testing During Construction

Test soil and base materials during construction as follows:

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Subbase or Base course	Soil classification	ASTM D 3282	One for each Soil material
	Moisture con- tent of subbase or base material (Just prior to compaction)	ASTM D 2216	
Soil materials prior to compaction	Moisture-den- sity relations of soil	AASHTO T 180, Method Bor D	One for each type of soil material
Soil material- in-place after com- paction	Unit Weight of soil-in-place	ASTM D 1556, Sand Cone Method, or ASTM D 2922, Nuclear Method	At least three daily for each soil material and for each layer; additional test whenever there is any change in moisture conditions

Provide tests and samples of bituminous-concrete mixtures for quality control during construction of the bituminous-concrete courses as follows:

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
In-place pavement	Density and thickness	As specified	One specimen for each 500 square yards of completed bitu- minous-concrete course

Provide a written test report of the results on the same day that tests are made.

A bituminous-concrete mixture that does not meet the requirements specified shall not be used in the specified work.

1.7 CONSTRUCTION EQUIPMENT LIST

The Contractor must submit a construction equipment list for all major equipment used for transporting, spreading and finishing prior to construction.

PART 2 PRODUCTS

2.1 SUBBASE AND BASE COURSE MATERIALS

Provide aggregate of clean, sound, durable particles; i.e., limerock crushed stone or crushed gravel and screening. Ensure aggregate be free of silt, clay, vegetable matter and other objectionable materials or coatings.

Apply gradation requirements to the completed subbase or base course after undergoing the mixing, placing, compacting and other operations. Provide aggregates of a maximum size of 2 inch and grade continuously within the limits specified below. Conform to ASTM E 11 for sieves.

GRADATION OF AGGREGATES

PERCENTAGE BY WEIGHT PASSING

SQUARE-MESH SIEVE

<u>SIEVE DESIGNATION</u>	<u>NO. 1</u>	<u>NO. 2</u>	<u>NO. 3</u>
2 inch	100	---	---
1-1/2 inch	70-100	100	---
1 inch	45-80	60-100	100
1/2 inch	30-60	30-65	40-70
No. 4	20-50	20-50	20-50
No. 10	15-40	15-40	15-40
No. 40	5-25	5-25	5-25
No. 200	0-10	0-10	0-10

2.2 BITUMINOUS CONCRETE

2.2.1 Aggregate for Bituminous-Concrete

Conform to ASTM D 692 for coarse aggregate.

Conform to ASTM D 1073 for fine aggregate. Sand equivalent value must be a minimum of 30.

2.2.2 Mineral Filler

Conform to ASTM D 242 for mineral filler for bituminous paving mixtures.

2.3 ASPHALT CEMENT

Furnish performance grade asphalt binder 58-28.

2.4 ASPHALT PRIME COAT

Provide bituminous prime coat of medium-curing cut-back asphalt conforming to ASTM D 2027, designation MC-70.

2.5 ASPHALT TACK COAT

Provide Bituminous tack coat of slow setting cut-back asphalt conforming to designation SS-1 and SS-1h.

2.6 JOB-MIX FORMULAS

Submit a job-mix formula for each bituminous-concrete mixture proposed for use in the work for approval prior to start of work.

Provide each job-mix formula within the limits specified for the particular type of bituminous-concrete mixture. Each job-mix formula must establish a single percentage of aggregate passing each required sieve size, a single percentage of asphalt cement to be added to the aggregate, and single temperature at which the bituminous-concrete mixture is to be produced.

2.7 PAVEMENT MARKING

Submit samples of White Paint and Reflective Beads (500 Grams) in one quart containers, unless otherwise noted.

2.7.1 Paint

Conform to AASHTO M 248 for paint, Type S, and DOT, Part III. Conform to standards of DOT, Part III for parking lanes and crosswalks.

2.7.2 Reflective Beads

Conform to AASHTO M 247, Type 1 for glass beads for reflectorized paint shall c.

PART 3 EXECUTION

3.1 SUBBASE OR BASE COURSE

3.1.1 Preparation of Subgrade or Subbase

Prior to constructing the subbase or base course, clean the previously constructed subgrade or subbase course of foreign substances. At the time of construction of the base course, do not contain frozen material for the subgrade or subbase course.

Correct ruts or soft, yielding spots that may appear in the subgrade or subbase course, areas having inadequate compaction and deviations of the surface from the requirements in the applicable section. Perform correction by loosening the affected areas, removing unsatisfactory material, adding approved material and reshaping and recompacting to line and grade to the specified density requirements.

3.1.2 Placing and Compacting

Level material to a uniform thickness so that the layer, after compaction, will not exceed 6 inch. Add water by sprinkling and mixing or reduced by aeration as necessary. Mix and aerate until the water content is at optimum. Compact layer through the full depth to the specified density. In places inaccessible to rolling equipment, compact approved mechanical compactors. Construct successive layers in a similar manner, scarifying between layers to ensure adequate bonding. Replace materials found unsatisfactory with satisfactory material or reworked to produce an acceptable standard.

3.1.3 Smoothness

Do not show deviations of surface of each layer in excess of 1/2 inch when tested with a 10-foot straightedge applied parallel with, and at right angles to, centerline of area to be paved.

3.1.4 Thickness Control

Completed thickness of the subbase or base course must be within 1/2 inch of plan. Measure thicknesses at intervals providing at least one depth measurement for each 500 square yards. Make depth measurement by test holes 3 inch minimum in diameter. Where the measured thickness is more than 1/2 inch deficient, correct the areas by scarifying, adding mixture of proper gradation, reblading, and recompacting. Provide average of job measurements within 1/4 inch thickness of plan.

3.2 ASPHALT CONCRETE SURFACE COURSE

3.2.1 Weather Limitations

Apply bituminous prime and tack coats only when the ambient temperature in the shade is above 50 degrees F or when the temperature has not been below 35 degrees F for 12 hours immediately prior to application. Application may commence when the aggregate base course is dry or contains moisture not in excess of the amount that will permit uniform distribution and the required penetration.

Construct bituminous-concrete courses only when the ambient temperature is above 40 degrees F and the underlying base course is dry.

3.2.2 Transportation of Mixtures

Transport bituminous-concrete mixtures from the mixing plant to the project site in trucks having tight, clean, smooth beds that have been coated with a minimum amount of a concentrated solution of hydrated lime and water to prevent adhesion of the mixture to the truck beds.

Cover each load of mixture with canvas or similar material of sufficient size and weight to retard heat loss and to protect the mixture from the weather.

In cool weather or for long hauls, insulate the entire contact area of each truck bed. Covers shall be securely fastened.

Schedule deliveries of the mixture so the placing and compaction can be completed during daylight unless satisfactory light is provided.

Deliver mixture in a such manner that the temperature of the mixture at the time of dumping into the paver will be not less than recommended by manufacturer.

Do not allow trucks to travel on the mixture until compaction is complete and the bituminous-concrete pavement surface will support traffic without measurable deformation.

3.3 PREPARATION OF AREA TO BE PAVED

3.3.1 Surface Preparation

Immediately before application of a bituminous prime coat to the aggregate base-course surface or other contact surface, remove loose material or other objectionable substances.

3.3.2 Priming the Base Course Surface

Apply a bituminous prime coat to the prepared base course surface. Rate of application must be within the range of 0.20 and 0.40 gallon per square yard of surface. Temperature of the bituminous material at the time of application must be within the range of 105 and 180 degrees F.

Provide proper care for the amount of prime coat at the junction of previous and subsequent applications is not in excess of that specified in the rate of application. Clean up the excess prime-coat material from the surface. Treat areas missed by the bituminous prime coat distributor with prime coat material by means of hand sprayers.

Following the application of prime coat material, allow the surface to dry without being disturbed for a period of not less than 48 hours or longer as may be necessary to attain penetration into the aggregate base course and evaporation of the volatile from the bituminous material. Do not permit blotting the prime coat with fine aggregate.

3.3.3 Priming Other Contact Surfaces

Apply a bituminous tack coat to the contact surfaces of previously constructed bituminous-concrete or portland-cement concrete pavement and other similar surfaces by means of a bituminous distributor. Rate of application must be 0.05 to 0.15 gallon per square yard of surface. Temperature of the bituminous material at the time of application must be 105 and 180 degrees F.

Contact surfaces of curbs, gutters, manholes, and other structures projecting into or abutting the concrete pavement must be coated with a thin, uniform coating of bituminous tack-coat material prior to the bituminous-concrete mixture being placed against such structures.

Following the application of the tack coat, allow the surface to dry until

it is in a condition of tackiness to receive the bituminous-concrete mixture. Clean up the excess tack-coat material from the surface.

3.4 PLACING BITUMINOUS-CONCRETE COURSES

3.4.1 General

Place bituminous-concrete mixture on the prepared surface, uniformly spread and struck off. Place bituminous-concrete courses in layers of approximately equal thickness except that no layer must be more than 2 inch thick after compaction. Courses must be so placed that, when compacted, they will conform to the indicated grade, cross-section, and thickness.

3.4.2 Pavement Placing

Adjust each paver and regulate the speed so that the surface of the bituminous-concrete mixture will be smooth and, when compacted, will conform to the depths, cross sections, grades, and contours indicated.

Begin placing along the centerline of areas to be paved on a crowned section, at the high side of a section with a one-way slope and in the direction of the traffic flow. Place the mixture for each course in strips not less than 10 feet wide. Progressive strip placement must commence after rolling of the first strip. Extend rolling to overlap the preceding strips. Placing the bituminous-concrete mixture must be continuous.

Experienced shovelers and rakers must follow each paver, adding hot bituminous-concrete mixture and raking the mixture as required to produce a course that, when completed, will conform to requirements specified.

3.4.3 Hand Placing

In areas where the use of machine spreading is not practicable, spread the mixture and finish by the use of heated hand tools.

Dump mixture on approved dump boards and distribute into place from the dump boards in a uniformly loose layer of a thickness that will, when compacted, conform to required grade and thickness. Take caution in the mixture so that it can be handled properly by the shovelers and rakers.

3.4.4 Joints

Provide joints of the same texture, density, and smoothness as other sections of the course. Joints between old and new pavements, or between successive days' work, must be made to ensure a continuous bond between the old and new sections of the pavement.

Offset transverse joints in succeeding courses at least 24 inch. Cut back the edge of the previously placed course to expose an even vertical surface over the full thickness of the course.

Offset longitudinal joints in succeeding courses at least 6 inch. When the edges of longitudinal joints are irregular or do not conform to the specifications, cut back the edge to expose an even vertical surface over

the full thickness of the course.

3.5 COMPACTION

3.5.1 General

Compaction must commence as soon after placing as the bituminous-concrete mixture will bear the weight of the roller without undue displacement.

Do not permit delays in compacting the freshly spread mixture.

During rolling, keep the wheels moist with the minimum amount of water required to avoid picking up the bituminous-concrete mixture.

In places not accessible to the rollers, compact the mixture with hot hand tampers.

3.5.2 Rolling Procedure

Rolling must commence longitudinally at the extreme sides of lanes and proceed toward the center of the pavement, except on superelevated curves. Rolling on superelevated curves must commence on the low side and progress to the high side, overlapping on successive trips by at least one-half the width of the rear wheel of the roller.

Allow alternate trips of the roller of slightly different lengths.

Move rollers at a slow but uniform speed with the drive roll or wheel nearest the paver. Do not exceed 3 miles per hour for steel-wheeled rollers or 5 miles per hour for pneumatic-tired rollers.

Do not park rollers on the pavement.

3.5.3 Initial Rolling

The initial rolling must immediately follow the rolling of the longitudinal joint and edges. Operate as close to the paver as possible without causing undue displacement.

Preliminary tests of crown, grade and smooth immediately after the initial rolling.

Before the rolling is continued, correct deficiencies by adding or removing material so that the finished course will conform to the specified requirements for grade and smoothness.

3.5.4 Second Rolling

Second rolling must follow the initial rolling as closely as possible, while the mixture is hot and in condition suitable for proper compaction.

Rolling must be continuous (at least 3 complete coverages) after the initial rolling until the mixture has been compacted.

Causing undue displacement will not be permitted.

3.5.5 Finish Rolling

Finish rolling must be done while the mixture is warm enough for the removal of roller marks. Rolling must continue until all roller marks are eliminated and the course has the specified density.

3.5.6 Patching Deficient Areas

Bituminous-concrete mixtures that become mixed with foreign material or that are defective, such as low areas or "bird-baths," must be removed, replaced with fresh bituminous-concrete mixture to obtain the required grade and smoothness for the finished surface, and compacted to the specified density.

Remove pavement in deficient areas to the full thickness of the bituminous-concrete course and so cut that the sides are perpendicular and parallel to the direction of traffic and the edges are vertical. Spray edges with bituminous tack-coat material.

Skin patching an area that has been rolled will not be permitted.

3.5.7 Protection of Pavement

After final rolling, do not permit vehicular traffic on the pavement until the pavement has cooled and hardened and in no case sooner than 6 hours.

3.6 ACCEPTANCE PROVISIONS

3.6.1 General

Test density, surface smoothness, and thickness of completed bituminous-concrete base and surface courses to verify compliance with the specified requirements.

3.6.2 Density and Thickness Requirements

Pavement specimens of each completed bituminous-concrete course must be taken on the basis specified. Diameter of pavement core specimens shall be not less than 3 inch, and must be through the entire base course and surface course. Locations for the removal of pavement specimens must be directed by the Contract Officer. Repair test holes.

Thickness must not vary from the indicated thickness by more than 1/2 inch for the base course and 1/4 inch for the surface course.

3.6.3 Surface Requirements

Test the finished surface of each bituminous-concrete course for smoothness with a 10-foot straightedge applied parallel with, and at right angles to, the centerline of the paved area. Check the entire paved area from one side to the other. Advancement along the pavement must be in successive stages of not more than half the length of the straightedge.

Base-course surface must not vary more than 1/4 inch from the straightedge.

Surface-course surface must not vary more than 1/8 inch from the straightedge.

Test crown of each bituminous-concrete course for conformance to the required cross section with a crown template centered on, and at right angles to, the centerline of the crown. Check crown along its entire length. Finished crown surface for each bituminous-concrete course must not vary more than 1/4 inch from the crown template.

Final surface must have a uniform texture and conforms to the required grade and cross section. Correct low or defective areas immediately by cutting out the faulty areas and replacing them.

3.7 PAVEMENT STRIPING

3.7.1 Surface Preparation

New pavement surfaces must be cured for 14 days before application of marking materials. Where oil or grease are present on old pavements, scrub the affected areas with approved detergent or degreaser, and rinsed thoroughly.

3.7.2 Traffic Control

Place traffic control markers along newly painted lines to prevent damage to newly painted surfaces.

3.7.3 Application

Apply paint recommended by the manufacturer, when the air and pavement temperatures are between 40 and 95 degrees F, with the relative humidity not higher than 85 percent at time of application.

Where reflectorized paint is specified, dispense glass beads at 10 pounds per gallon of paint.

Markings must be sharply outlined, with uniform thickness, and with industry standard widths.

If there is a deficiency in drying of the markings, discontinue painting operations until the cause of the slow drying time is determined and corrected.

If discoloration occurs due to bleeding of bituminous materials, apply two coats of paint.

-- End of Section --

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SECTION 02755

PORTLAND CEMENT CONCRETE PAVING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ACI INTERNATIONAL (ACI)

ACI 211.1 (1997) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

ACI 305R (1999) Hot Weather Concreting

ACI 325.9R (1991) Guide for Construction of Concrete Pavements and Concrete Bases

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182 (1991; R 2000) Burlap Cloth Made from Jute or Kenaf

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M (2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 184/A 184M (2001) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement

ASTM A 185 (2002) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete

ASTM A 307 (2003) Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

ASTM A 615/A 615M (2004) Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM C 1107 (2002) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink)

ASTM C 143/C 143M (2003) Standard Test Method for Slump of

Hydraulic-Cement Concrete

ASTM C 150	(2002a ¹) Standard Specification for Portland Cement
ASTM C 171	(2003) Standard Specification for Sheet Materials for Curing Concrete
ASTM C 172	(1999) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C 231	(2003) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2001) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C 309	(2003) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 31	(2000e ¹) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(2003) Standard Specification for Concrete Aggregates
ASTM C 494/C 494M	(2004) Standard Specification for Chemical Admixtures for Concrete
ASTM C 94/C 94M	(2003a) Standard Specification for Ready-Mixed Concrete
ASTM D 1190	(1997) Standard Specification for Concrete Joint Sealer, Hot-Applied Elastic Type
ASTM D 1752	(2004) Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 1 MSP	(2001e ²⁷) Manual of Standard Practice
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U.S. DEPARTMENT OF DEFENSE (DOD)

MS MIL-L-3150	(1986c) Lubricating Oil, Preservative, Medium
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1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL

PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Construction Equipment List shall be submitted in accordance with paragraph entitled, "Construction Equipment List," of this section.

Daily Activity Report shall be submitted in accordance with paragraph entitled, "Concrete Testing During Construction," of this section.

SD-02 Shop Drawings

Fabrication Drawings for the following items shall be submitted in accordance with paragraph entitled, "Drawings," of this section.

Reinforcing Steel
Bar Lists

Erection/Installation Drawings shall be submitted for the following items in accordance with paragraph entitled, "Drawings," of this section.

Reinforcing Steel
Bar Lists
Expansion and Construction Joint Details

SD-05 Design Data

Mix designs (Contractor and job) shall be submitted in accordance with paragraph entitled, "Concrete Mix Design," of this section.

SD-06 Test Reports

Test Reports for the following items shall be submitted in accordance with the paragraph entitled, "Concrete Testing During Construction," of this section.

Concrete Slump
Air Content
Test Specimens
Beam
Drilled Cores
Daily Activity Report
Location of Placement
Quantity in Cubic Yards of Placement
Quantity in Square Yards of Placement

Start Time of Pourer Placement

SD-07 Certificates

Certificates for the following items shall be submitted in

accordance with the applicable referenced standards and descriptions contained in this section:

- Wire Mesh
- Fabricated Bar Mats
- Reinforcing Bars
- Joint Dowel Bars
- Hook Bolts
- Load-Transfer Devices
- Metal Joint Inserts
- Joint Materials
- Curing Materials
- Form Materials
- Concrete Materials
- Concrete Mix Design

SD-08 Manufacturer's Instructions

Manufacturer's instructions for the following items shall be submitted in accordance with applicable paragraphs that each refer to in this section.

- Cold-Weather Curing
- Hot-Weather Curing
- Curing Methods
- Sawing Concrete Joints
- Joint Sealant

SD-11 Closeout Submittals

The following shall be submitted in accordance with paragraphs entitled, "Concrete Testing During Construction" and "Ready-Mixed Concrete," of this section.

- Ending Time of Placement
- Delivery Tickets

1.3 SOURCE OF SUPPLY

Source of supply for materials shall be approved at least 15 calendar days before use. Source of materials shall not be changed except by written authorization.

1.4 DELIVERY AND STORAGE OF REINFORCING STEEL

Reinforcing steel shall be delivered, handled, and stored in accordance with the CRSI 1 MSP.

Reinforcement shall be segregated as to type, size, and length and placed in orderly piles on blocking or racks.

Piles of reinforcement shall be barricaded and have warning signs in the day and warning lights at night.

1.5 MAINTENANCE OF TRAFFIC

Vehicular and pedestrian traffic shall be maintained. Contractor shall keep open an adequate traffic lane or shall provide for a detour route.

Detours over roads within Government property shall be as approved and shall be designated and marked with proper signs.

1.6 CONNECTIONS WITH OTHER ROADS

Connections with other roads and public entrances shall be kept in a condition for the safe passage of traffic. When directed, the Contractor shall apply stabilization or surfacing material, or both, to connections and entrances at no additional cost to the Government.

1.7 PROTECTION OF PERSONS AND PROPERTY

Pavement work shall be conducted in a manner that will ensure the safety of persons and property.

Structures, utilities, sidewalks, existing pavements, and other facilities immediately adjacent to new pavement work shall be protected against damage, including settlement, lateral movement, undermining, and washout.

1.8 CONSTRUCTION EQUIPMENT LIST

Construction Equipment List for all major equipment to be used for this particular work shall be submitted by the Contractor prior to work.

1.9 DRAWINGS

Fabrication Drawings shall be submitted showing size and spacing for Reinforcing Steel and Bar Lists with reference to the contract design.

Erection/Installation Drawings shall be submitted including the size and spacing for Reinforcing Steel, Bar Lists and Expansion and Construction Joint Details with reference to the contract design.

PART 2 PRODUCTS

2.1 REINFORCING MATERIALS

2.1.1 General

Reinforcing materials shall be clean, straight, and shop-fabricated to the indicated dimensions.

2.1.2 Wire Mesh

Mesh shall be welded, plain, cold-drawn steel wire fabric conforming to ASTM A 185.

2.1.3 Fabricated Bar Mats

Mats shall be welded or clip-assembled steel bars, size as indicated, and shall conform to ASTM A 184/A 184M. Bars used in fabrication of mats shall be Grade 60 deformed billet-steel bars conforming to ASTM A 615/A 615M.

2.1.4 Reinforcing Bars

Reinforcing bars and tie bars shall be deformed billet-steel bars, Grade 60, conforming to ASTM A 615/A 615M.

2.1.5 Joint Dowel Bars

Dowel bars for load transfer, expansion joints, and transverse contraction joints in reinforced concrete slabs shall be plain billet steel bars, Grade 60, conforming to ASTM A 615/A 615M. Bars shall be cut true to length with ends square and free of burrs.

2.1.6 Metal Expansion Caps

Metal expansion caps shall be provided for one end of each dowel bar in expansion joints. Caps shall be closed on one end with minimum lengths of 3 inches and shall be designed to allow a subsequent movement of at least 1 inch of each bar.

2.1.7 Hook Bolts

Hook bolts shall be ASTM A 307, Grade A bolts, externally and internally threaded. Bolts shall be not less than 9/16-inch diameter.

Joint hook bolt assembly shall be designed to hold the coupling against the pavement form and in the designated position during placing and finishing the concrete and shall permit removal without damage to the concrete or hook bolt.

2.1.8 Metal Accessories

Reinforcing bar accessories, chairs, ties, slab bolsters, and spacers shall be cold-drawn, industrial-quality, basic wire corrugated or straight, clean, and free of rust, furnished in sizes and quantities to adequately support reinforcement.

2.1.9 Load-Transfer Devices

Load-transfer devices for supporting dowels at expansion and contraction joints shall be constructed to hold the dowels firmly in position parallel to the surface and centerline of the slab.

Construction of the devices shall conform to ACI 325.9R.

2.1.10 Metal Joint Inserts

Metal-joint inserts for contraction joints shall be formed of zinc-coated steel sheets conforming to ASTM A 123/A 123M, Type 1, Class e, lightly zinc coated for severe forming.

2.2 JOINT MATERIALS

2.2.1 Preformed Joint Fillers

Fillers shall be preformed, nonextruding, resilient fillers conforming to ASTM D 1752, thickness as indicated.

2.2.2 Wood-Joint Fillers

Wood-joint fillers for temporary joint filling shall be sound heart redwood as approved.

2.2.3 Elastic-Joint Sealant

Joint sealant shall be a hot-poured rubber-modified asphalt joint sealer conforming to ASTM D 1190.

2.3 CURING MATERIALS

2.3.1 Cotton Mats

Cotton mats shall consist of a filling material of cotton covered with unsized cloth tufted or stitched to maintain the shape and stability of the unit, as approved.

Burlap cloth shall be made from jute or kenaf, plain weave, weighing 10 ounces per square yard, conforming to AASHTO M 182, Class 3.

2.3.2 Impervious Sheeting

Waterproof paper shall be fiber reinforced, non staining, white, two-ply kraft paper conforming to ASTM C 171.

Polyethylene sheeting shall be white polyethylene film, 4-mil (0.004 inch) minimum thickness, with water-retention capability conforming to ASTM C 171.

2.3.3 Liquid Membrane-Forming Compounds

Liquid membrane-forming compounds shall be a spray-applied, white-pigmented compound conforming to ASTM C 309.

2.3.4 Water Curing

Curing water shall be clean and free of deleterious substances.

2.4 FORM MATERIALS

2.4.1 General

Forms shall be of sufficient strength to resist springing during placement of concrete and to remain in vertical and horizontal alignment until removed.

Forms shall be free of distortion and defects and shall extend the full

depth of the concrete. Defective forms shall be replaced with new or repaired forms at no additional cost to the Government.

2.4.2 Steel Forms

Forms and accessories shall be steel, conforming to ACI 325.9R.

Forms shall include spring-steel flexible forms for forming curves and corner forms, form spreaders, and fillers as required.

2.4.3 Wood Forms

Wood forms shall be 2-inch nominal thick planks, surfaced four sides, straight, free of defects, clean, and well-oiled.

Wood forms shall have a nominal length of 10 feet, with a minimum of three stakes per form at a maximum spacing of 4 feet. Corners, deep sections, and radius bends shall have additional stakes and braces as required.

Radius bends may be formed with 3/8-inch boards laminated to the required thickness.

2.4.4 Form Coating

Form oil shall be a nonstaining clear compound that will not discolor or injure the concrete.

2.5 CONCRETE MATERIALS

2.5.1 Aggregates

Aggregates shall conform to ASTM C 33.

Fine Aggregates shall be natural or manufactured sand.

Coarse Aggregates shall be crushed stone or crushed gravel.

2.5.2 Air-Entraining Admixtures

Material shall be a liquid air-entraining admixture conforming to ASTM C 260.

2.5.3 Fly Ash and Pozzolan

ASTM C 618, Type F, except that the maximum allowable loss on ignition shall be 6%, maximum available alkalies content shall be 1.5%, and maximum calcium oxide (CaO) content 8%. Fly ash certificates shall include test results in accordance with ASTM C 618, including available alkalies indicated in the Supplementary Optional Chemical Requirements.

2.5.4 Slag

ASTM C 989, Ground Granulated Blast Furnace Slag (GGBFS), Grade 100 or 120. Certificates shall include test results in accordance with ASTM C 989.

2.5.5 Set-Retarding Admixtures

Set-retarding admixtures shall conform to ASTM C 494/C 494M.

2.5.6 Portland Cement

Portland cement shall conform to ASTM C 150, Type V.

2.5.7 Mixing Water

Mixing water shall be potable.

2.6 CONCRETE MIX DESIGN

Concrete shall be portland cement concrete with an air-entraining admixture, with a minimum modulus of rupture of 4,000 pounds per square inch (psi) at 28 calendar days, and a maximum slump of 4 inches.

Proportions of the concrete-mix design shall be determined by tests conducted in accordance with the basic relations and procedures outlined in ACI 211.1, using at least three different water-cement ratios. Under no circumstances shall the maximum water-cement ratio nor the minimum cement content be changed outside the limits specified for the quality of concrete to be used in the work.

Concrete-mix design test specimens shall be made as specified.

PART 3 EXECUTION

3.1 CONCRETE SAMPLING AND TESTING

3.1.1 Concrete Testing During Construction

Concrete shall be tested for quality control during construction as follows:

<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Sampling fresh concrete	ASTM C 172	(*) One for each flexure, slump, and air-content test
Making and curing concrete Test Specimens in the field	ASTM C 31	At least one set of test specimens (six per set) for each 100 cubic yards or fraction thereof; one when the material source changes
Concrete Slump	ASTM C 143/C 143M	One to supplement each set of test specimens, three daily or more often at the

<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u> request of Contract- ing Officer
Air Content of freshly mixed concrete	ASTM C 231	One to supplement each set of test specimens. Additional tests if air content falls outside limits

(*) Concrete samples for testing shall be taken from the point of placement and not from the point of manufacture or point of discharge from the mixer.

Slump and air content tests shall be made from the same batch from which strength tests are made. Results of the concrete slump and air content tests shall be submitted within 24 hours after placement, along with the Contractor's Daily Activity Report. The Contractor's Daily Activity Report will include the following: location of placement, Quantity in Cubic Yards of Placement, Quantity in Square Yards of Placement, Start Time of Pourer Placement, Ending Time of Placement and Delivery Tickets Copy.

To conform to requirements of this specification, the average of the 28-day strength tests of a set of specimens as well as the average of any five consecutive 28-day strength tests of a set of specimens shall be equal to, or greater than, the specified strength, and not more than one test in 10 shall have an average value of less than 90 percent of the specified strength. Should the tests fall below the strength specified, immediate corrective action shall be taken as directed.

Core holes shall be refilled with Portland cement concrete bonded to the pavement with a two-component polysulfide epoxy binder.

3.1.2 Mixer Performance Tests

Mechanical details of the mixers and agitators shall be checked before use. Slump tests from individual samples at the beginning, midpoint, and end of the load shall be taken.

If the slump measurements vary by more than 2 inches, use of the mixer or agitator shall be discontinued until the condition is corrected. Slump test shall be in accordance with ASTM C 143/C 143M

3.2 MEASUREMENT OF CONCRETE MATERIALS

Aggregates, cement, mixing water, and air-entraining admixtures shall be measured in accordance with ACI 325.9R. Measurements shall conform to the accuracy limits listed for each material.

Air-entraining measuring device shall be capable of ready adjustment to permit varying the quantity of admixture to be batched. Dispenser shall be interlocked with the batching and discharging operations of the water so that the batching and discharging of the admixture will be automatic. When use of truck mixers makes this requirement impractical, the

air-entraining-admixture dispenser shall be interlocked with the sand batcher.

3.3 MIXING AND DELIVERY OF CONCRETE

Method and location of batching, mixing, and delivery of concrete shall be approved prior to the beginning of the work and shall conform to the following:

Ready-mixed concrete shall be from a ready-mix plant located off Government property.

3.4 BATCHING PLANT ON GOVERNMENT PROPERTY

3.4.1 Cement For Batching Plant

Cement may be furnished in bulk or in bags marked with the manufacturer's name and brand. Cement shall be dry and free from lumps and caking when delivered. Bulk cement shall be delivered in weathertight carriers and unloaded into the storage facilities by means of weathertight conveyors or other suitable means that will protect the cement from exposure to moisture. Immediately upon receipt at the site of the work, bagged cement shall be stored in a dry, weathertight, properly ventilated structure. Different brands of cement shall be stored separately and shall not be intermixed.

Shipments of cement shall be checked for weight when delivered, and accurate scales and labor for checking the weight of bagged cement shall be furnished by the Contractor. Approximately 1 percent of each shipment shall be selected at random and checked for weight, except that additional weight checks shall be made to determine compliance with the specification when deficiencies in weight are found.

Cement salvaged by cleaning bags or from discarded bags of cement shall not be used in the work.

3.4.2 Concrete-Aggregate Storage

Aggregates shall be handled and stored to avoid breakage, segregation, or contamination by foreign materials. Bulldozers shall not be used to move or distribute aggregate in stockpiles.

3.4.3 Storage of Admixtures

Admixtures shall be stored and handled in a manner that will prevent contamination or deterioration. Use of frozen or damaged admixtures will not be allowed.

3.4.4 Batch-Plant Concrete

Concrete shall be mixed in a stationary mixer, a truck mixer, or a paver mixer. Mixer shall be designed and maintained to ensure both a uniform mixture of materials and discharge of this mixture without segregation.

Mixers and mixing time for concrete shall conform to the requirements of ASTM C 94/C 94M, except as follows:

Use of nonagitating equipment will not be permitted.

When a truck mixer or agitator is used for transporting concrete, the concrete shall be delivered and discharge completed within 60 minutes or before the drum has turned 300 revolutions, whichever comes first. Discharge shall be completed no more than 20 minutes after the mixing water has been added. Mixing operation shall begin within 30 minutes after the cement has intermingled with the aggregates.

3.5 READY-MIXED CONCRETE

Ready-mixed concrete shall conform to the requirements of ASTM C 94/C 94M, with modifications in the referenced ASTM specification as follows:

Section 4, "Materials." Delete in its entirety. Materials shall be as specified.

Section 5, "Ordering Information." Delete and substitute the following:

At least 10 calendar days before delivery of the concrete, the Contractor shall furnish a statement giving the source and properties of the proposed concrete-mix materials and the proposed concrete-mix design strength tests for the class of concrete specified. Changes in the source of materials or the concrete-mix proportions shall not be made without prior written authorization.

Proportions of the concrete mix design shall be determined by tests conducted in accordance with the basic relations and procedures outlined in ACI 211.1, using at least three different water-cement ratios. Under no circumstances shall the maximum water-cement ratio nor the minimum cement content be changed outside the limits specified for the class of concrete to be used in the work.

Section 6, "Tolerances in Slump." Delete subsections 6.1.1 and 6.1.2 and substitute the following: Slump shall be not more than the value specified.

Section 11.3, "Central-Mixing Concrete." Delete the reference to nonagitating equipment. Use of nonagitating equipment will not be permitted.

Section 11.7. Delete and substitute the following: When a truck mixer or agitator is used for mixing or delivery of concrete, no water from the truck water system or elsewhere shall be added after the initial introduction of the mixing water for the batch. Concrete shall be delivered to the site of the work and discharge completed within 1-1/2 hours, or before the drum has turned 300 revolutions, whichever comes first, after the introduction of cement to the aggregates, except that in hot weather when the temperature of the concrete is 85 degrees F and above, the 1-1/2-hour mixing and delivery time shall be reduced to 45 minutes. When a truck mixer is used for the complete mixing of the concrete, the

mixing operation shall begin within 30 minutes after the cement has been intermingled with the aggregates.

Section 16, "Batch Ticket Information." Add the following: With each load of concrete delivered to the site of the work, the ready-mixed concrete manufacturer shall furnish 2 Delivery Tickets. In addition to the requirements of Section 16.1, delivery tickets shall provide the following information:

Type and brand name of cement

Amount of cement per cubic yard of concrete

Maximum size of aggregate

Weights of fine and coarse aggregate

Amount and brand name of air-entraining admixture

Total water content expressed by water-cement ratio

Certification that all ingredients are as approved

Strength, frequency, and number of flexural strength tests shall be as specified.

Section 18. Delete in its entirety.

3.6 HOT- AND COLD-WEATHER MIXING

During hot-weather conditions, aggregates and mixing water shall be kept as cool as possible. Chilled water or chopped ice shall be used, provided the water equivalent of the ice is calculated in the total proportion of mixing water. Aggregates shall be cooled by sprinkling immediately before use. Cement with a temperature in excess of 80 degrees F shall not be used.

Concrete delivered in cold weather shall have a temperature at the time of placing of not less than 60 degrees F or more than 80 degrees F. Aggregates and mixing water shall be heated and mixed uniformly in the mixer before cement is introduced and in accordance with ACI 306R.

3.7 FORM WORK

3.7.1 Setting Forms

Forms shall be set to the required line and grade and braced and staked to resist the pressure of concrete placement, and shall have uniform bearing throughout their entire lengths and widths.

Sufficient forms shall be provided to allow continuous progress of the work without the necessity of removing forms less than 12 hours after placing concrete.

Forms shall be cleaned and oiled with nonstaining mineral oil immediately

before the concrete is placed.

Should the subgrade between forms become rutted or disturbed, it shall be reshaped and compacted to specified tolerances.

Before concrete is placed, the subgrade or base course between forms shall be made true with a subgrade planer.

3.7.2 Form Tolerance

After forms are set in place, their top surface shall be checked for grade; trueness shall be verified with a straightedge not less than 10-feet long. Top of the form shall vary not more than 1/8 inch in 10 feet, and the longitudinal axis of the vertical face shall vary not more than 1/4 inch in 10 feet.

3.8 PLACING CONCRETE

3.8.1 General

Concrete shall not be placed until the subgrade, base course, and forms have been approved for line and grade. Subgrade shall be moistened to provide a uniformly dampened condition at the time concrete is placed.

Retempered concrete or concrete which has partially hardened shall not be deposited.

Exposed, newly placed concrete shall be protected.

3.8.2 Cold-Weather Placing

Concrete shall be placed, protected, and cured in accordance with ACI 306R.

3.8.3 Hot-Weather Placing

Concrete shall be placed, protected, and cured in accordance with ACI 305R.

3.8.4 Mechanical Spreading of Concrete

Concrete shall be spread by a mechanical spreader as soon as it is deposited on the subgrade, in a manner to avoid segregation and with as little rehandling as possible. Concrete along the face of the forms and adjacent to transverse joints shall be consolidated by internal vibration. Vibrators shall not come in contact with a joint assembly, reinforcement, or side forms.

Depositing and spreading concrete shall be continuous, as far as possible, between transverse joints. In the event of an unavoidable interruption of the work continuing more than 1/2 hour, a construction joint shall be placed. Sections less than 15 feet in length between transverse joints will not be permitted and, if constructed, shall be removed at the Contractor's expense.

Workmen with shoes coated with earth or foreign material shall be forbidden

to walk in the freshly placed concrete or on finished concrete.

When adjacent pavement lanes are poured in separate pours, mechanical equipment shall not be operated on the recently placed pavement until the pavement has obtained a modulus of rupture strength of at least 2,000 psi, as indicated by test specimens. If finishing equipment only is carried on the existing lane, paving may be permitted after that lane has attained a modulus of rupture strength of 2,000 psi.

3.8.5 Hand Spreading of the Concrete

Hand spreading of concrete will be permitted only when necessary and shall be done with square-faced shovels; rakes or hoes shall not be used.

Except where reinforcing steel is indicated, concrete shall be placed and spread in one course, monolithic construction, and consolidated by internal vibration, spading, and tamping along the face of the forms and at joints to remove voids and honeycomb. Hand spreading shall be done with square-faced shovels; rakes or hoes shall not be used.

Depositing and spreading concrete shall be continuous, as far as possible, between transverse joints. In the event of an unavoidable interruption of the work continuing more than 1/2 hour, a construction joint shall be placed. Sections less than 15 feet in length between transverse joints will not be permitted and, if constructed, shall be removed at the Contractor's expense.

Finishing operations shall not begin until surface water has disappeared or is removed in an approved manner. Applying dry cement as an absorptive material will not be permitted.

Retempered concrete or concrete which has partially hardened shall not be deposited.

3.8.6 Placing Reinforcing Steel

When reinforcement is required, the concrete shall be placed in two operations. Initial pour shall be struck off to the entire width of the pour the required depth below the finished surface. Reinforcement shall be laid full length in final position without further manipulation. Top layer of concrete shall then be placed, struck off and screeded. Any portion of the bottom layer of concrete which has been placed more than 30 minutes without being covered with the top layer shall be removed and replaced without additional cost to the Government.

Wire-mesh reinforcement shall be end-lapped one full mesh plus 2 inches; edge laps shall be not less than 2 inches. Laps shall be securely fastened at each edge and at two additional points along the top.

Reinforcement steel shall not be distributed along the road but shall be placed in the concrete slab directly from the hauling equipment or from a bridge riding on the forms, except for irregular widths and where the use of hauling equipment is not practicable.

Longitudinal bars of fabricated bar mats shall have a lap of at least 30 diameters.

Width of the wire-reinforcement sheets or bar mats shall be 4-inches less than the width of the slab. Allowable number of sheets between contraction joints or between contraction and expansion joints shall not exceed four.

Length of wire fabric or bar mats, when properly placed in the work, shall be such that the reinforcement will clear transverse joints by not less than 2 inches nor more than 4 inches.

3.9 JOINTS

3.9.1 General

Joints shall conform to ACI 325.9R and the specified requirements, except where indicated otherwise.

Joints shall be constructed true to line with the face perpendicular to the surface of the pavement. Longitudinal joints shall be constructed parallel to the centerline of the pavement, unless otherwise required, and shall vary not more than 1/2 inch from the designated position. Transverse joints shall be constructed at right angles to the centerline of the pavement, and shall vary not more than 1/4 inch from a true line. In no case shall the joint fall outside the center 3 inches of the load-transfer device.

When the pavement is laid in partial-width slabs, or where existing pavements are being widened, transverse joints in the new slab shall be placed in line with similar joints in the existing pavement.

3.9.2 Longitudinal Joints

Longitudinal joints shall be longitudinal-lane tie joints with tie bars or bulkhead construction with hook bolts.

Longitudinal-lane tie joints shall be weakened-plane joints formed by an approved metal-screed joint or a mechanically formed groove placed while the concrete is in a plastic state. A 3/8-inch wide by 1/2-inch deep sealing groove shall be provided to receive the joint sealant.

Longitudinal bulkhead construction joints with hook bolts shall be used in partial-width construction of concrete pavement and where a concrete curb or combination curb and gutter is constructed adjacent to the concrete pavement. A 3/8-inch wide by 1/2-inch deep sealing groove shall be provided to receive the joint sealant.

Longitudinal bulkhead construction joints with hook bolts and couplings shall be attached to the forms or otherwise held in position during placing and finishing concrete to permit removal of pavement forms without damage to the concrete or hook-bolt assembly. Ends of couplings shall be protected from concrete, dirt, and damage. A rust-preventive oil conforming to MS MIL-L-3150 shall be applied into the ends of couplings. Ends shall be sealed with a rubber or plastic plug.

3.9.3 Transverse Contraction Joints

Transverse contraction joints in reinforced concrete pavement shall include a load-transfer unit and a weakened-plane joint formed in the slab by a formed-metal insert. Metal insert shall be designed to receive a poured joint sealant.

Dowel bars shall be accurately held in place to within 1/8 inch per foot of length from the designated line and grade. One end of each dowel bar shall be free to move in the slab. Two-thirds of the length of each dowel shall be coated with cutback asphalt. Cutback asphalt coating shall be dry and shall not be removed by handling and placing dowels in the joint.

Joints in plain concrete pavement shall consist of a weakened-plane joint formed in the slab by means of a metal insert. Metal insert shall be designed to receive a poured joint sealant.

Joints shall be spaced at a maximum of 30-foot intervals for reinforced concrete pavement and at 20-foot intervals for plain concrete pavement.

3.9.4 Construction Joints

Construction joints shall be placed at the end of pours and at places where paving operations are stopped for a period of more than 1/2 hour, except where such pours end at expansion joints.

Except where indicated otherwise, construction joints in both plain and reinforced pavement shall have a load-transfer device of the same type specified in ACI 325.9R.

Construction joints shall be constructed with a 3/8-inch wide by 1/2-inch deep sealing groove formed in the second pour by a wood or fiberboard temporary filler.

3.9.5 Expansion Joints

Expansion joints shall be spaced as indicated and shall include a load-transfer unit and a premolded joint filler, except that the premolded joint filler without the load-transfer unit shall be used for joints abutting concrete walks, curbs, structures, catch basins, manholes, inlets, and other fixed objects.

Load-transfer unit and dowels for expansion joints shall conform to ACI 325.9R, except where indicated otherwise.

3.9.6 Joint Fillers

Joint fillers for expansion joints shall extend the full width and depth of the joint. After installation, the top shall be not less than 1/2 inch and no more than 1 inch below the finished surface.

Joint fillers shall be furnished in lengths not less than the lane width being poured. Where more than one length is required, the sections shall

be securely laced or clipped together.

Joint fillers shall be held in place during installation by an approved installing device. Top edge of the filler shall be protected with metal cap or an approved temporary filler while concrete is being placed.

3.9.7 Sawing Concrete Joints

Joints constructed by sawing shall be in accordance with ACI 325.9R.

Joints constructed with a concrete saw shall be cut as soon as concrete has hardened sufficiently to prevent edge damage. Width of the joint shall be approximately 1/8 inch and shall be widened at top of groove to 3/8-inch wide by 1/2-inch deep. Depth of the groove cut shall be approximately one-fourth of the depth of the slab or to the depth indicated.

Sawing concrete shall be limited to widening joints to receive sealant and for joint repairs and minor jointing. Concrete sawing shall not be used to form contraction or weakened-plane joints.

3.10 FINISHING CONCRETE

3.10.1 General

Concrete finishing shall be performed by finishing machine or hand-finishing methods, as approved.

3.10.2 Striking Off and Consolidating Concrete

Immediately after depositing, the concrete shall be struck off and consolidated by an approved finishing machine or float to conform to the finished grade. While striking off, a uniform ridge of concrete shall be maintained ahead of the screed for its entire length. Sufficient mortar shall be worked to the surface to provide a dense, smooth finish. Excessive operation of the machine over a given area will not be permitted. Concrete shall be compacted by mechanical vibration or by approved hand methods for the full width of the slab and adjacent to joints to prevent voids and segregation from occurring against joint material, load-transfer devices, and joint-assembly units.

Equipment that cannot produce the required compaction and surface finish will be considered unsatisfactory. Contractor shall then furnish alternate equipment and methods that shall produce satisfactory pavement at no additional cost to the Government.

3.10.3 Floating Concrete

After the concrete has been struck off and consolidated, the surface shall be smoothed by means of a mechanical float or by a suspended pan float. Where mechanical floating is not possible, hand methods may be used, as approved.

Mechanical float shall be adjusted so that the float will pass over each section of pavement at least twice and may make one or two additional trips

if required to properly compact the concrete and to produce a uniform surface texture. Excessive operation over an area will not be permitted.

3.10.4 Straightedging and Surface Correction

After floating has been completed but while the concrete is still plastic, the surface shall be tested for trueness with a 10-foot straightedge.

Straightedge shall be placed at the center of the slab with the blade parallel to the centerline and pulled slowly and uniformly to the edge. Operation shall be repeated until the surface of the concrete is free from irregularities and is in continuous contact with the bottom of the straightedge. Straightedge shall then be moved forward half its length, and the operation repeated.

Depressions in the surface shall be filled with freshly mixed concrete, struck off, consolidated, refinished, and retested.

3.10.5 Final Finish

As soon as excess moisture or sheen has disappeared and while it is still possible to produce a uniform surface of gritty texture, the pavement shall be finished by dragging a seamless strip of damp burlap or cotton fabric not less than 5 feet nor more than 10 feet in width over the full width of the pavement. Drag shall be pulled by a self-propelled foot bridge supported on the forms. Pavement shall be given a final finish by dragging the burlap over the full width of the pavement for a second time.

3.10.6 Edging at Forms and Joints

Edges of the slab, transverse joints, and construction joints shall be worked with an edging tool and rounded to the required radius.

Tool marks appearing on the surface of the slab shall be eliminated.

Joints shall be tested with a 10-foot straightedge before the concrete has set and correction shall be made to align joints with each other and with adjacent slabs.

3.10.7 Hand Finishing

Hand finishing concrete pavements will be permitted when approved and under the following conditions:

- To finish concrete already deposited in the event of a breakdown of mechanical equipment

- To finish narrow widths or irregular areas where operation of the mechanical equipment is impractical

- To finish minor amount of concrete paving where the use of mechanical equipment is impractical and hand finishing would be the normal procedure

Hand finishing concrete pavement shall conform to ACI 325.9R and shall be performed by approved methods and equipment.

When striking off and consolidating by hand methods, pours shall be limited to single-lane widths or less, unless otherwise approved.

3.10.8 Surface Test

On the day following placing of the concrete, the pavement shall be tested with a 10-foot straightedge parallel with, and perpendicular to, the centerline as directed. Areas showing high spots exceeding 1/8 inch but not exceeding 1/2 inch in 10 feet shall be marked and removed. Where the departure from the correct cross section exceeds 1/2 inch, the pavement shall be removed and replaced at the expense of the Contractor.

Any section removed shall be not less than 10 feet in length and not less than the full width of the lane. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joints that is less than 10 feet in length shall also be removed and replaced.

3.10.9 Removing Forms

Forms shall remain in place at least 12 hours after concrete has been placed, then shall be removed in a manner that will avoid damage to the pavement.

3.10.10 Honeycombed Or Defective Work

After the forms have been removed, the ends of joints shall be cleaned and minor honeycombed areas shall be pointed. Areas designated as "major honeycombed areas" will be considered defective work and shall be removed and replaced at the expense of the Contractor. An area or section so removed shall be not less than 10 feet in length and not less than the full width of the lane. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joints that is less than 10 feet in length shall also be removed and replaced.

3.11 CURING

3.11.1 General

Freshly deposited concrete shall be protected from premature drying and maintained with minimum moisture loss at a relatively constant temperature for the period of time necessary for the hydration of the cement and proper hardening of the concrete.

3.11.2 Cold-Weather Curing

Concrete shall be protected and cured to prevent loss of moisture and to maintain the recommended concrete temperatures for cold-weather concreting in accordance with ACI 306R.

3.11.3 Hot-Weather Curing

Concrete shall be protected and cured for 7 calendar days during hot weather or during conditions of rapid drying of concrete in accordance with ACI 305R.

Contractor shall have facilities ready for curing operations. Exposed surfaces shall be protected from drying. Wherever practical, continuous water curing is preferable.

Windbreakers or sun-shading screens shall be provided when required by wind or drying conditions.

3.11.4 Curing Methods

Except during conditions of cold weather concreting, exposed concrete surfaces shall be wet cured for a minimum of 48 hours, beginning the process immediately after the finishing operations have been completed and as soon as concrete has hardened sufficiently to preclude surface damage. Concrete shall be cured by means of one or more of the methods listed:

Continuous water spray: Continuous water spray of exposed concrete surfaces shall be achieved by use of soil-soaker hoses or fog-spray nozzles to keep the surface moist but not flooded for the curing period.

Wetted burlap or cotton mats: Exposed concrete surfaces shall be covered with two or more layers of wetted burlap cloth or cotton mats. Material shall be saturated with water both night and day and held securely in place during the initial curing period.

Wetted straw or hay: Exposed concrete shall be covered with clean, loose straw or hay at the rate of 4 pounds per square yard. Straw covering shall be wetted as soon as it is placed and kept saturated for the duration of the initial curing period.

If the covering becomes displaced during the curing period, it shall be replaced immediately.

Waste straw shall be disposed as specified.

3.11.5 Final Curing

Final curing of exposed concrete surfaces shall be achieved by continuing the method of initial wet curing for the duration of the curing period or by the use of one of the following:

Impervious sheets: Exposed concrete surfaces shall be covered with polyethylene sheets or kraft paper. Adjoining sheets shall be lapped at least 6 inches and shall overlap ends at least 12 inches. Joints shall be cemented or taped to form a continuous membrane. Sheets shall be in good condition; all perforations, tears, holes, or rips shall immediately be patched. Curing sheets shall be folded over exposed edges of concrete and secured in place.

A liquid membrane-forming compound shall be applied under constant

pressure to exposed concrete surfaces in one or two uniform spray applications, as directed, at a rate of 150 square feet per gallon of material by means of an approved pressure sprayer. Portable spray equipment shall be used for curing irregular-width pours or where the total amount of concrete is small.

At the time of use, the curing compound shall be in a mixed state. Spray equipment shall provide effective stirring of the compound during application.

Curing compound shall not be permitted to enter joints, nor shall it be allowed on surfaces to be subsequently joined with other concrete surfaces.

Spraying unit shall be equipped with a calibrated gage to ensure the quantity applied is as required. Unit shall provide a fine fog spray to the surface of the concrete.

An additional coat of compound shall be applied to all surfaces showing a discontinuity of coverage. Damage to any area covered with curing compound within the 7-day curing period shall be resprayed as specified.

Contractor shall provide alternate methods or equipment for the protection of the pavement in case of a breakdown of spray equipment.

Failure to provide complete and uniform coverage at the required rate will be cause for discontinuation of this curing method.

3.12 JOINT SEALING

3.12.1 Preparation

Temporary fillers shall be removed manually or with a saw cut. Joint opening and adjacent concrete surfaces shall be cleaned of extraneous matter.

Cleaning shall be accomplished by sand blasting or other approved methods. Residue from a sawed groove or the dust and sand present after sand blasting or cleaning shall be removed.

3.12.2 Joint Sealant

Longitudinal and transverse, expansion, and isolation joints shall be sealed with the specified elastic joint sealant.

Joint sealant shall be handled, prepared, and placed in strict accordance with the manufacturer's printed or certified instructions. Special care shall be taken to preclude damage by overheating the sealant.

A copy of the manufacturer's printed or certified instructions shall be on the job for inspection and use before beginning the work.

Sealant shall not be placed when the air temperature is less than 50 degrees F in the shade.

Each joint shall be cleaned of foreign matter, including membrane-curing compound, and the joint faces shall be clean and surface dry when the seal is applied.

Immediately after cleaning, joints shall be sealed in accordance with the manufacturer's written directions, completely filling the joint. Sealant shall be stirred during heating so that localized overheating does not occur.

Sealing compound spilled on the surface of the concrete outside the joint or adjacent surfaces shall be removed immediately.

Traffic shall not be permitted over the poured joint until the compound has hardened sufficiently to resist picking up of sealing compound. Sand or similar material shall not be used as a cover for the seal.

3.13 PREPARATION OF ANTISPALLING TREATMENT

Compound shall be applied to concrete no sooner than 28 calendar days after placement. Concrete surfaces shall be clean, dry, and free of oil, grime, and loose particles at the time of each application.

3.13.1 Precautions

Antispalling compound shall not be heated. Material shall be transported, handled, and applied with due regard to its low flash point. Contractor shall guard against open flame, smoking, sparks, and fire adjacent to open containers or applicators.

Antispalling compound shall be applied at air temperatures of 50 to 90 degrees F. Compound shall not be applied at air temperatures lower than 50 degrees F.

3.13.2 Application

Material shall be applied in accordance with the manufacturer's printed or certified instructions.

Two sprayed-on coats of compound shall be applied. First coat shall be applied at a rate of 35 to 40 square yards per gallon; second coat at 55 to 60 square yards per gallon. Time shall be allowed for complete drying between coats.

Equipment shall be clean before use to avoid discoloration of concrete. Coated surfaces shall be protected from vehicular and pedestrian traffic until dry.

3.14 DEFECTIVE PAVEMENT

3.14.1 Repairs and Replacement of Pavement Slabs

Broken or defective slabs shall be replaced or repaired at no additional cost to the Government.

Nonreinforced concrete pavement slabs that contain the following defects shall be removed and replaced:

Pavement slabs with multiple cracks through the full depth of the slab separating the slab into three or more parts between contraction joints

Pavement slabs with one or more cracks through the pavement extending diagonally across more than one-third of the slab, in either a transverse or longitudinal direction. Pavement slabs containing a single diagonal crack intersecting the transverse and longitudinal joints within one-third of the width and length of the slab from the corner shall be repaired by removing and replacing the smaller portion of the slab.

Random cracks penetrating the full depth of the pavement shall be grooved and sealed with the specific joint sealant. Sealing groove shall be approximately 1/2-inch wide and 3/4-inch deep.

Random cracks that are tight and do not penetrate the full depth of the pavement shall be left undisturbed.

When necessary, the depth of crack penetration shall be determined by inspection of test cores, not less than 4 inches in diameter, drilled by the Contractor at his expense, at locations directed. Core holes shall be refilled with portland cement concrete bonded to the pavement with polysulfide epoxy binder or with nonshrink grout conforming to ASTM C 1107.

When a transverse random crack terminates in or crosses a transverse contraction joint, the uncracked portion of the joint shall be filled with epoxy resin mortar or grout and the crack routed and sealed with the specified joint sealant. When a transverse random crack approximately parallels the planned contraction joint and is within 25 percent of the slab length from a contraction joint in nonreinforced pavement, the crack shall be routed and sealed and the joint filled with a bonded grout. When a transverse random crack is more than 25 percent of a slab length from the nearest contraction joint in nonreinforced pavement, both the joint and the crack shall be sealed with the specified joint sealant.

3.14.2 Pavement Protection and Opening to Traffic

Pavement shall be protected from damage until acceptance of the work. Traffic shall be excluded from the pavement until the concrete is at least 14 calendar days old.

To expedite construction, operation of paving mixers and batch hauling equipment will be permitted on new pavement after the pavement has been cured for at least 7 calendar days, the joints have been sealed or protected.

Pavement carrying construction traffic or equipment shall be kept clean, and spillage of materials or concrete shall be immediately removed. Damage to pavement caused by equipment or traffic on the pavement before

acceptance shall be corrected by repairing or replacing pavement at no additional cost to the Government.

3.15 CLEANUP AND WASTE DISPOSAL

Contractor shall clean up the site and dispose of waste materials and debris in accordance with Division 1.

After completion of the protection and curing period, insulating and curing materials shall be removed. Joints shall be sealed and excess materials removed from the site. Straw shall be removed from the site or distributed where directed.

Concrete surfaces shall be swept and washed free of stains, discolorations, and loose particles.

-- End of Section --

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SECTION 02773

CONCRETE CURB AND GUTTER

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ACI INTERNATIONAL (ACI)

ACI 305R	(1999) Hot Weather Concreting
ACI 306R	(1988) Cold Weather Concreting
ACI 315	(1999) Details and Detailing of Concrete Reinforcement
ACI 318/318R	(2002) Building Code Requirements for Structural Concrete and Commentary

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182	(1991; R 2000) Burlap Cloth Made from Jute or Kenaf
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ASTM INTERNATIONAL (ASTM)

ASTM A 615/A 615M	(2004) Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 138/C 138M	(2001a) Standard Test Method for Density ("Unit Weight"), Yield, and Air Content (Gravimetric) of Concrete
ASTM C 143/C 143M	(2003) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C 150	(2002a ¹) Standard Specification for Portland Cement
ASTM C 171	(2003) Standard Specification for Sheet Materials for Curing Concrete
ASTM C 172	(1999) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C 173/C 173M	(2001e ¹) Standard Test Method for Air Content of Freshly Mixed Concrete by the

Volumetric Method

ASTM C 231	(2003) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2001) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C 309	(2003) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 31	(2000e1) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(2003) Standard Specification for Concrete Aggregates
ASTM C 330	(2004) Standard Specification for Lightweight Aggregates for Structural Concrete
ASTM C 618	(2003) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 685/C 685M	(2001) Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C 94/C 94M	(2003a) Standard Specification for Ready-Mixed Concrete
ASTM D 1190	(1997) Standard Specification for Concrete Joint Sealer, Hot-Applied Elastic Type
ASTM D 1751	(1999) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-05 Design Data

Mix design data shall be submitted for approval of each concrete class in accordance with paragraph entitled, "Concrete-Mix Design," of this section, as required for machine placement.

Design for machine placement shall equal or exceed the specified design.

SD-06 Test Reports

Test reports, except when specified otherwise, shall be submitted for each referenced standard in accordance with paragraph entitled, "Quality Control During Construction," of this section. Additional reports will be required if material source changes, or there is a change in material.

Slump
Compression Test
Concrete Temperature
Air Content
Yield
Air Dried Unit Weight
Unit Weight of Fresh Concrete

SD-07 Certificates

Certificates of compliance shall be submitted for the following items showing conformance with the referenced standards contained in this section. Certificates shall contain project name and number, date, name of Contractor, name of concrete testing service, source of concrete aggregates, material manufacturer, brand name of manufactured materials, material name, values as specified for each material, and test results.

Reinforcing Steel
Form Materials
Curing Materials
Joint Materials
Concrete Materials
Concrete-Mix Design

SD-08 Manufacturer's Instructions

Manufacturer's instructions shall be submitted for Concrete Curbs and Gutters in accordance with paragraph entitled, "Machine Placement," of this section.

1.3 SAMPLING AND TESTING

Sampling and testing services shall be provided by the Contractor. Testing services shall be approved and shall perform sampling and testing to determine conformance to reference specifications and for quality control.

1.4 QUALITY CONTROL DURING CONSTRUCTION

Concrete samples shall be submitted and tested as follows:

<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Sampling	ASTM C 172	As required for each test
Slump	ASTM C 143/C 143M	One for each concrete load, one each time water adjustment is made, and one for each set of compressive-strength tests
Compression Test specimens	ASTM C 31	One set of six standard cylinders for each compressive-strength test for each 100 cubic yards
Concrete Temperature		Hourly when air temperature is 40 degrees F and below or 80 degrees F and above and each time a set of compressive-test specimens is made
Air Content or by pressure method	ASTM C 173/C 173M	
Yield	ASTM C 231	
	ASTM C 138/C 138M	
Air Dried Unit Weight	ASTM C 330	After curing
Unit Weight of Fresh Concrete	ASTM C 138/C 138M	One for each set compressive strength tests

1.5 SUBGRADE PREPARATION

Subgrade shall conform to Section 02315, "Excavation and Fill."

PART 2 PRODUCTS

2.1 REINFORCING STEEL

Reinforcing bars shall be deformed billet steel conforming to ASTM A 615/A 615M. Bars shall be free of rust, mill scale, or a combination of both, clean, straight, and shop fabricated to the length and shape indicated.

2.2 FORM MATERIALS

Forms shall be of ample strength to resist springing during placement of concrete and to remain in vertical and horizontal alignment until they are removed. Forms shall be straight, free of distortion or defects, and extend the full depth of the concrete. Forms shall be substantial and sufficiently tight to prevent leakage of mortar. Defective forms shall be removed and replaced with new or repaired forms as approved at no additional cost to the Government. Forms may be wood or steel.

Form oil shall be a clear compound that will not discolor or injure the concrete.

2.3 CURING MATERIALS

2.3.1 Curing Mats

Mats shall consist of a filling material of cotton batts, covered with unsized cloth tufted or stitched to maintain the shape and stability, as approved.

Burlap cloth shall be made from jute or kenaf and shall be plain weave, weighing 10 ounces per square yard, conforming to AASHTO M 182, Class 3.

2.3.2 Moisture-Retaining Cover

Cover shall be fiber-reinforced, two-ply, nonstaining, white waterproof paper; 4-mil, white, opaque polyethylene film; or 4-mil burlap-polyethylene sheet, conforming to ASTM C 171.

2.3.3 Liquid Membrane-Forming Compounds

Compounds shall be spray applied, white pigmented, conforming to ASTM C 309.

2.3.4 Water

Water shall be potable.

2.4 JOINT MATERIALS

2.4.1 Fillers

Preformed fillers shall be nonextruding, resilient, bituminous, conforming to ASTM D 1751.

2.4.2 Joint Sealant

Sealants shall be hot-poured rubber-modified asphalt joint sealer conforming to ASTM D 1190.

2.5 CONCRETE MATERIALS

Aggregates shall conform to ASTM C 33.

Portland cement shall conform to ASTM C 150, Type V.

Water shall be potable.

Air-entraining admixtures shall be subject to prior approval of the Contracting Officer and shall conform to ASTM C 260.

Fly ash is required as an admixture and shall conform to ASTM C 618, Class C or F. Fly ash replacement of cement shall not exceed 20 percent (maximum one part fly ash to four parts cement) by weight.

2.6 CONCRETE-MIX DESIGN

Concrete shall be air-entrained portland cement concrete with a minimum modulus of rupture of 4,000 pounds per square inch at 28 calendar days, air content of 5 to 8 percent, and maximum slump of 4 inches. Concrete mix design data shall be provided by an approved testing service.

Ready-mixed concrete shall be mixed and delivered in accordance with ASTM C 94/C 94M or ASTM C 685/C 685M.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

Subgrade shall conform to Section 02315, "Excavation and Fill." The subgrade shall be dampened to provide a uniform moistened condition at the time the concrete is placed, except in freezing weather.

3.2 FORM WORK

3.2.1 Placing

Forms and their supports shall be designed and placed so as not to damage any previously placed structure.

Forms shall be installed as specified with 1/4-inch transverse expansion joints spaced at a maximum of 30 feet on center.

Forms shall be oiled with an approved oil immediately before concrete is placed.

3.2.2 Removal

Forms shall remain in place for a minimum of 12 hours. Tool contact shall not be made with concrete when forms are being removed. Concrete to be exposed by form removal shall have sufficient strength not to be damaged by the removal operation.

3.2.3 Tolerance

Forms shall conform to line, grade, and vertical position with an allowable tolerance of 1/8 inch in any 10-footlong section and no more than 3/8 inch in accumulated deviation.

3.3 PLACING REINFORCING STEEL

Dowels, reinforcing bars, and tie bars shall be spaced and held in position while placing concrete by use of bar chairs or other approved devices and shall terminate 2 inches from each expansion and construction joint. Installation of reinforcing steel shall be in accordance with ACI 315 and ACI 318/318R.

3.4 PLACING CONCRETE

3.4.1 General

Concrete shall not be placed until the subgrade and forms have been approved. Except in freezing weather, the subgrade shall be dampened as required to provide a uniform moistened condition at the time concrete is placed.

Concrete shall be placed using single-course monolithic construction and shall be consolidated by vibrators or vibratory screeds.

Concrete shall be struck off to true surfaces and floated before excess water has bled to the surface.

Finishing operations shall not begin until the water has disappeared. Applying dry cement as an absorptive material will not be permitted.

Retempered concrete or concrete which has partially hardened shall not be deposited.

3.4.2 Machine Placement

Manufacturer's instructions shall be submitted for Concrete Curbs and Gutters including special provisions required to install equipment components and system packages. Special notices shall detail impedances, hazards and safety precautions.

An automatic curb-and-gutter machine may be used for concrete placement, when permitted, subject to the following conditions:

Contractor shall submit a revised concrete-mix design for approval as required for machine placement. Design for machine placement shall equal or exceed the specified design.

Required cross section and a satisfactory finish shall be obtained.

Curbs and gutters shall be held to line and grade as indicated and shall have expansion, contraction, and construction joints as indicated.

If use of mechanical placement machines produces unsatisfactory work, such use shall be discontinued and the defective work removed. Combination curbs and gutters, formed and placed as specified, shall then be provided.

3.4.3 Hot-Weather Concreting

Hot-weather concreting shall be in accordance with ACI 305R.

3.4.4 Cold-Weather Concreting

Cold-weather concreting shall be in accordance with ACI 306R.

3.5 FINISHING CONCRETE

3.5.1 Exposed Surfaces

Surfaces shall be floated to a smooth and even surface, with sufficient mortar brought to the surface for final finishing. Final surface finish shall be a uniform gritty texture produced by a moistened float, followed by light longitudinal brushing using either a brush or burlap drag. Finished surfaces of combination curbs and gutters shall have a uniform texture free of waves and irregularities. Surfaces shall be true to line and grade with variations no greater than 1/8 inch under a 10-foot straightedge.

3.5.2 Edges and Joints

Edges of gutter, back top edges of curbs, and transverse and planes-of-weakness joints (except saw cut) shall be rounded to a radius of 1/4 inch.

Faces of curbs at top and bottom shall be rounded to the radii indicated on the drawings.

Saw-cut joints shall be square-edge, and the slurry resulting from sawing operations shall be removed from joints and the adjacent concrete.

Edges of joints between sections shall be flush on exposed surfaces.

3.6 JOINTS

3.6.1 General

Longitudinal and transverse construction, contraction, and expansion joints shall conform to details as indicated.

Joints shall be constructed true to line with faces perpendicular to the surfaces of combination curbs and gutters. Transverse joints shall be constructed at right angles to the centerline of curbs, and shall vary not more than 1/8 inch from a true line.

Contraction joints constructed with a concrete saw shall be cut as soon as the concrete has hardened sufficiently to prevent edge damage. Joint width shall be approximately 1/8 inch. Depth of the cut groove shall be approximately 1/4 of the depth of the section or to the depth indicated on the drawings. Sealing grooves shall be cut to the profile indicated on the drawings.

Joints constructed adjacent to or integral with concrete pavement shall be the same type, thickness, and material and spaced to match the joints in concrete pavement.

3.6.2 Construction Joints

Longitudinal joints between combination curbs and gutters and concrete pavement shall be bulkhead or keyed construction, with 3/8-inch wide by 1/2-inch deep sealing groove.

Longitudinal joints between combination concrete curbs and gutters and bituminous-concrete pavement shall be unbonded butt joints without dowels or sealing grooves.

Transverse joints between adjoining sections of combination curbs and gutters shall be constructed with doweled butt joints, as indicated on the drawings.

3.6.3 Contraction Joints

Combination curbs and gutters shall have transverse joints at 10-foot intervals. Joints may be constructed with metal separator plates, by use of a grooving tool, or saw cut. Depth of joints shall average 2 inches or more.

3.6.4 Expansion Joints

Transverse joints shall be provided in combination curbs and gutters at a spacing of 30 feet on center.

Expansion or isolation joints shall be provided where combination curbs and gutters abut concrete sidewalks, manholes, catch basins, inlets, structures, or other fixed objects and at locations and spacing indicated.

3.6.5 Fillers

Premolded joint fillers for expansion joints shall be cut to the profile of the combination curb and gutter and shall extend the full width and depth of the joint. After installation, the top shall be not less than 1/2 inch and no more than 1 inch below the finished surface.

3.6.6 Sealant

After completion of the curing period, expansion and isolation joints shall be sealed with the specified joint sealant.

Each joint shall be cleaned of foreign matter, including membrane-curing compound, and joint faces shall be clean and dry when the sealant is applied.

Immediately after cleaning, joints shall be sealed with the specified joint sealant poured to fill joint.

Sealing compound spilled on the surface of concrete or adjacent surfaces shall be removed immediately.

Compound shall be placed in accordance with manufacturer's instructions.

Traffic shall not be permitted over poured joints until the compound has hardened sufficiently to prevent pickup of sealing compound. Sand shall not be used as a cover for seal.

3.7 CURING

3.7.1 General

Freshly deposited concrete shall be protected from premature drying and excessive hot or cold temperatures during the curing period.

3.7.2 Initial Curing

Except during cold-weather concreting, exposed concrete surfaces shall be wet-cured for a minimum of 48 hours, beginning the process as soon as the concrete has hardened sufficiently to withstand surface damage. Concrete shall be cured by means of one or more of the methods listed:

Continuous water spray:

A continuous water spray of exposed concrete surfaces shall be achieved by use of soil soaker hoses or fog-spray nozzles operated to keep the surface moist during the curing period.

Burlap or cotton mats:

Exposed concrete surfaces shall be covered with two or more layers of wetted burlap cloth or cotton mats. Material shall be kept saturated with water both night and day, and secured in place during the initial curing period.

Straw or hay:

Exposed concrete shall be covered with clean, loose straw or hay at not less than 4 pounds per square yard. Straw covering shall be wetted as soon as it has been placed and kept saturated for the duration of the initial curing period.

Covering displaced during the curing period shall be replaced immediately and wet down.

3.7.3 Final Curing

Final curing of exposed concrete surfaces shall be achieved by continuing the method of the initial wet curing for the duration of the curing period or by use of one of the following:

Moisture-Retaining Covers:

Exposed concrete surfaces shall be covered with moisture-retaining covering sheets. Adjoining sheets shall be lapped by at least 6 inches and shall overlap ends by at least 12 inches. Joints shall be cemented or taped to form a continuous membrane. Perforations, tears, holes, or rips shall be immediately patched. Curing sheets shall be folded over exposed edges of concrete and secured in place.

Liquid membrane-forming compound:

Compound shall be applied to exposed concrete surfaces in one or two uniform spray applications at a rate of 200 square feet per gallon of material.

Curing compound shall not be permitted to enter joints, nor shall it be allowed on surfaces to be subsequently joined with other concrete surfaces.

Spraying unit shall be equipped with a calibrated gage to ensure that the specified quantity is applied. Unit shall provide a spray to the surface of the concrete as recommended by the manufacturer.

An additional coat of compound shall be applied to surfaces showing discontinuity of coverage. Areas covered with curing compound and damaged by construction operations within the 7-day curing period shall be resprayed as specified.

Failure to provide complete and uniform coverage will be cause for discontinuation of this curing method.

3.8 DISPOSAL OF WASTE MATERIALS

3.8.1 Removal from Government Property

Waste materials shall be removed from Government property and legally disposed at no additional cost to the Government. Permits and fees for disposal shall be paid by the Contractor.

-- End of Section --

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SECTION 02811

UNDERGROUND SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ASTM INTERNATIONAL (ASTM)

ASTM D 1784 (2003) Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80 (2003) Bronze Gate, Globe, Angle and Check Valves

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2003) Enclosures for Electric Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

ASTM INTERNATIONAL (ASTM)

ASTM D 1785 (1999) Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120

ASTM D 2464 (1999) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

As-Built Drawings shall be submitted in accordance with the paragraph entitled, "Drawings," of this section.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Piping
Gate Valves
Quick-Coupling Valves
Check Valves
Automatic Controllers, Electrical
Remote Control Valves, Electrical
Electrical Power, Supply Voltage
Sprinkler Heads

Spare Parts Data for the complete sprinkler system shall be submitted. Data shall include a complete list of parts and supplies, with current unit prices and source of supply; a list of parts and supplies that are either normally furnished at no extra cost with the purchase of equipment, or specified to be furnished as part of the contract; and a list of additional items recommended by the manufacturer to ensure efficient operation for a period of 120 calendar days at the particular installation.

SD-06 Test Reports

Test reports for Hydrostatic Test shall be submitted.

SD-07 Certificates

Certificates of compliance shall be submitted for the following items in accordance with the applicable reference standards and description of this section:

Piping
Gate Valves
Quick-Coupling Valves
Check Valves
Automatic Controllers, Electrical
Remote Control Valves, Electrical
Electrical Power, Supply Voltage
Sprinkler Heads

SD-08 Manufacturer's Instructions

Manufacturer's instructions for Equipment and System Packages shall be submitted in accordance with the paragraph entitled, "Equipment Systems Packages," of this section.

The following Special Tools shall be submitted upon completion of the project:

Keys
Coupler(s)/Matching Hose Swivels.

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be submitted in accordance with the paragraph entitled, "Equipment Systems Packages," of this section.

1.3 SPECIAL REQUIREMENTS

The Contractor shall coordinate the installation of sprinkler materials with the landscape drawings to avoid interfering with planting.

The Contractor shall verify location and dimensions for sprinkler system lines before commencing excavation.

The Contractor shall replace existing paving disturbed during the course of this work at no additional cost to the Government. New paving shall be equal in every way to the material removed.

The Contractor shall obtain and pay for permits and inspections required.

1.4 CONTROLLER CHARTS

The Contractor shall provide one controller chart for each controller supplied, showing the area covered by the automatic controller.

When completed and approved, the charts shall be hermetically sealed between two pieces of plastic, each piece being a minimum 20 mils thick.

1.5 MATERIAL, EQUIPMENT AND FIXTURE LISTS

Material, Equipment, and Fixture Lists for major components of the sprinkler system shall be submitted prior to start of work.

1.6 DRAWINGS

As-Built Drawings shall be submitted with current factual information including deviations from, and amendments to the drawings and changes in the work, concealed and visible.

1.7 EQUIPMENT SYSTEMS PACKAGES

Manufacturer's instructions shall be submitted for Equipment and System Packages requiring special provisions. Special notices shall detail impedances, hazards and safety precautions.

Operation and Maintenance Manuals shall be submitted bound in manual format and grouped by technical sections consisting of manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions.

1.8 SPECIAL TOOLS

1.8.1 Keys

Two keys for each automatic controller shall be provided by the Contractor

upon completion of the project.

1.8.2 Coupler(s)/Matching Hose Swivels

Four coupler(s) and matching hose swivels, equipped with globe valves shall be provided by the Contractor upon completion of the project.

1.9 SPARE PARTS DATA

Spare Parts Data for the complete sprinkler system shall be submitted. Data shall include a complete list of parts and supplies, with current unit prices and source of supply; a list of parts and supplies that are either normally furnished at no extra cost with the purchase of equipment, or specified to be furnished as part of the contract; and a list of additional items recommended by the manufacturer to ensure efficient operation for a period of 120 calendar days at the particular installation.

PART 2 PRODUCTS

2.1 PIPING, GENERAL

Supply lines shall be PVC, Schedule 40.

2.2 PLASTIC PIPE AND FITTINGS

Solvent weld pipe shall be extruded of an improved polyvinylchloride (PVC) virgin pipe compound. The compound shall conform to ASTM D 1784, Cell Classification 12454-B, and have a 2,000-pound per square inch (psi) hydrostatic design stress rating.

Pipe shall bear the following markings: manufacturer's name, nominal pipe size, schedule or class, pressure rating in psi, and NSF International (NSF) seal.

Solvent cement or rubber-gasket joints for pipe and fittings shall be made as prescribed by the manufacturer.

Fittings shall be standard weight, Schedule 40.

Fittings shall be injection molded of an improved PVC compound. Fittings shall conform to ASTM D 1784, Cell Classification 12454-B.

Tees and ells shall be side-gated.

Fittings shall bear the company's name and trademark, material designation, size, applicable iron pipe size (ips) schedule, and NSF seal of approval.

Threaded nipples shall be standard-weight, Schedule 80, with molded threads.

2.3 GATE VALVES

Gate valves under 3 inches shall be in accordance with MSS SP-80, 1/4 - 3 inch, Class 150, and Style Screwed in Bonnet, threaded ends.

Valves shall be housed as detailed. Valves in traffic areas shall be enclosed in concrete with cast-iron lids.

2.4 QUICK-COUPLING VALVES

Bodies of valves shall be brass parts and shall be two-piece unit consisting of a coupler water seal valve assembly and a removable upper body to allow spring and key track to be serviced without shutdown of main.

Lids shall be lockable vinyl with spring for positive closure on key removal.

Valves shall have 1 inch female threads opening at base.

2.5 CHECK VALVES

Swing check valves 3 inches and smaller shall be bronze construction, 100-pound rating, female.

Antidrain valves shall be plastic construction with soft composition disks and internal parts of corrosion-resistant steel. The spring tension shall be adjustable from 4 to 15 psi.

2.6 AUTOMATIC CONTROLLERS, ELECTRICAL

Controllers and wiring shall conform to the requirements of Section 16145, "Standard Wiring Systems," and Section 16286, "Overcurrent Protective Devices."

Controllers shall be fully automatic and capable of operating the number of stations indicated.

Controllers shall be wall-mounted with a heavy-duty, weather-proof, watertight case and locking hinged cover with a hasp for a padlock.

Controllers shall be programmed for various schedules to comply with central controller system already on base.

Components shall be UL listed and shall have acceptable overcurrent protection by means of circuit breakers or fuses. Controller chassis shall be grounded.

Controllers shall be equipped with approved disconnect switches rated for 120-volt service. Electrical receptacles shall be located inside housings.

Exact location of controllers shall be determined in the field before installation. The Contractor shall be responsible for coordinating the electrical service to these locations.

2.7 REMOTE CONTROL VALVES, ELECTRICAL

Valves shall be spring-loaded, packless diaphragm-activated, with plastic bodies and corrosion-resistant steel trim and seats, normally closed, equipped with flow controls.

Valves shall be slow closing (10 seconds minimum) with no adjustments or settings required.

Valves shall be capable of being operated in the field, without electricity at controllers, by bleeder valves.

Valves shall be installed where shown on drawing and installed according to details.

2.8 ELECTRICAL POWER, SUPPLY VOLTAGE

Wiring shall conform to the requirements of Section 16145, "Standard Wiring Systems."

Power and connection to the automatic controller will be provided by contractor.

2.9 WIRING, CONTROL VOLTAGE

Wiring shall conform to the requirements of Section 16145, "Standard Wiring Systems."

Connections between the controllers and remote control valves shall be made with direct-burial Type UF wire, sized and installed in accordance with NFPA 70 and the valve manufacturer's wire chart and specifications.

Wiring shall occupy the same trenches and be installed along the same route as the supply lines, wherever possible.

Where more than one wire is placed in a trench, the wiring shall be taped together at intervals of 30 feet.

Splices shall be made using Scotch-Lok Unipack waterproof sealing packets, Pen-Tite Connectors, or equal. An expansion loop of 12 inches shall be provided at each wire connection and directional turn.

Wire sizing shall be according to the manufacturer's recommendations, and in no case less than No. 14 AWG in size.

A continuous wire shall be used between the controller and remote-control valves. Under no circumstances shall splices exist without prior approval. Any splices allowed shall be installed in an approved box conforming to NEMA 250.

Ground wires shall be green.

2.10 SMALL LAWN SPRINKLER HEADS

Fixed-head pop-up sprinklers shall have removable spray tip nozzles of full-, half-, third-, or quarter-circle pattern, as required. The pop-up feature should consist of a piston to which a spray-tip nozzle is attached. It shall have a synthetic rubber gasket and be of sufficient height to permit it to rise at least 1 inch while in operation.

Lawn heads shall be adjustable by means of setscrews.

2.11 TREE IRRIGATORS

Trees shown with drip as indicated.

PART 3 EXECUTION

3.1 INSPECTION SCHEDULE

The Contractor shall notify the Contracting Officer, in advance as indicated, for the following inspections:

Prejob conference - 7 calendar days

Supply-line installation and testing - 36 hours

System layout - 36 hours

Coverage tests - 36 hours

Final inspection - 48 hours

As-built drawings shall be available for all inspections.

During performance of the final inspection, the Contractor shall be responsible for having radio communication capabilities or sufficient personnel so that directions from the inspection area to the controller of the system can be readily accomplished.

3.2 WATER SUPPLY

Connections to the outlet shall be at approximate locations shown. Minor changes caused by actual site conditions shall be made without additional cost to the Government.

3.3 LAYOUT

Sprinkler heads shall be laid out, making minor adjustments required due to differences between sites and drawings, without additional cost to the Government.

3.4 GRADES

Before the start of work, grades shall be verified to determine that the work may safely proceed, keeping within specified material depths.

3.5 ASSEMBLIES

Backflow assemblies shall be installed as shown on plumbing drawings.

Supply lines as indicated are diagrammatic. Lines (and various assemblies) shall be installed to conform to details.

Multiple assemblies shall not be installed on plastic lines. Each assembly shall be provided with its own outlet. When indicated, the pressure-relief valve shall be the last assembly.

Assemblies specified shall be installed according to the respective drawings and specifications.

Brass pipe and fittings and plastic pipe and threaded fittings shall be assembled using Teflon tape applied to male threads only.

3.6 LINE CLEARANCE

Lines shall have a minimum clearance of 4 inches from each other and 6 inches from lines of other trades, unless specified or indicated otherwise.

Parallel lines shall not be installed directly above one another.

3.7 TRENCHING

The pipe shall be supported continuously on the bottom of the ditches and laid to an even grade. Where lines occur under paved area, dimensions shall be considered below subgrade.

A minimum cover of 18 inches shall be provided over pressure-supply lines 2-1/2 inches and smaller.

A minimum cover of 18 inches shall be provided over control wire.

A minimum cover of 12 inches shall be provided over nonpressure lines.

3.8 BACKFILLING

Initial backfill shall be of a fine granular material with no stones larger than 1/2 inch in any dimension.

Backfill for trenching shall be compacted to a density equal to the adjacent undisturbed soil and shall conform to adjacent grades without irregularities.

Under no circumstances shall truck wheels be used for compacting soil.

3.9 FLUSHING THE SYSTEM

After lines and risers are in place and connected, and prior to installation of sprinkler heads, control valves shall be opened and a full head of water used to flush out the system.

3.10 SPRINKLER HEADS

Sprinkler heads shall be installed as indicated.

Spacing of heads shall not exceed the maximum indicated. In no case shall the spacing exceed the maximum recommended by the manufacturer.

3.11 COVERAGE TEST

When the sprinkler system is completed, a coverage test shall be performed to determine if the water coverage for lawn, planting, and turf areas is complete and adequate. Materials and work required to correct valve alignment and inadequacies of coverage shall be provided by the Contractor at no additional cost to the Government. This test shall be accomplished before ground cover and planting operations commence.

3.12 TESTS

Pipe ditches shall not be backfilled until the pipe has been inspected, tested, and approved in writing.

The Contractor shall furnish the necessary test equipment.

A Hydrostatic Test shall be performed by the Contractor. Pressure-supply lines shall be tested under a hydrostatic pressure of 150 psi for a period of 2 hours. Any visible leakage shall be repaired, and the system tested again.

Testing shall be approved prior to the installation of remote-control valves, quick couplers, or other valve assemblies.

3.13 FINAL CLEANUP

Upon completion of the work, the Contractor shall remove equipment, materials, and debris resulting from the installation.

-- End of Section --

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SECTION 02825

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ASTM INTERNATIONAL (ASTM)

ASTM A 153/A 153M	(2004) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 390	(1995; R 2001) Standard Specification for Zinc-Coated (Galvanized) Steel Poultry Fence Fabric (Hexagonal and Straight Line)
ASTM A 702	(1989; R 2000) Standard Specification for Steel Fence Posts and Assemblies, Hot Wrought
ASTM A 780	(2001) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A 90/A 90M	(2001) Standard Test Method for Weight (Mass) of Coating on Iron or Steel Articles with Zinc or Zinc Alloy
ASTM C 94/C 94M	(2003a) Standard Specification for Ready-Mixed Concrete
ASTM F 1234	(1993) Standard Specification for Protective Coating on Steel Framework for Fences
ASTM F 626	(1996a; R 2003) Standard Specification for Fence Fittings

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Erection/Installation Drawings shall be submitted for the following items in accordance with paragraph entitled, "Assembly

and Installation," of this section.

Fence Assembly
Gate Assembly
Gate Hardware and Accessories

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Fence Assembly
Gate Assembly
Gate Hardware and Accessories

SD-04 Samples

Contractor shall submit the following samples described within this section:

Fabric
Supporting Arms
Gate Hardware and Accessories
Wire Ties

SD-07 Certificates

Certificates of compliance shall be submitted in accordance with the applicable reference standards and descriptions of this section for the following items:

Zinc Coating
Fabric
Stretcher Bars
Gate Hardware and Accessories
Concrete

SD-08 Manufacturer's Instructions

Manufacturer's instructions shall be submitted for the following items:

Fence Assembly
Gate Assembly
Hardware Assembly
Accessories

1.3 ASSEMBLY AND INSTALLATION

Contractor shall provide manufacturer's instructions that detail proper assembly and materials in the design for fence, gate, hardware and accessories.

Erection/Installation drawings shall be submitted along with manufacturer's

catalog data for Complete fence assembly, gate assembly, hardware assembly and accessories.

PART 2 PRODUCTS

2.1 GENERAL

Fencing materials shall conform to the requirements of ASTM A 116, ASTM A 121, ASTM A 390, ASTM A 584, ASTM A 702, ASTM F 626, and as specified.

2.2 ZINC COATING

Ferrous-metal components and accessories, except as otherwise specified, shall be hot-dip galvanized after fabrication.

Weight of zinc coating shall not be less than 1.8 ounces per square foot, as determined from the average result of two specimens, when tested in accordance with ASTM A 90/A 90M.

Zinc coating shall conform to the requirements of the following:

Hardware and accessories: ASTM A 153/A 153M, Table 1

Surface (ASTM F 1234):

External: Type B-B surface zinc with organic coating, 0.9 ounce per square foot minimum thickness of acrylated polymer.

Internal: Surface zinc coating of 0.9 ounce per square foot minimum.

Galvanizing repair material shall be a cold-applied zinc-rich coating conforming to ASTM A 780.

2.3 FABRIC

Fabric shall consist of No. 9-gage wires woven into a 2-inch diamond mesh, with dimensions of fabric and wire conforming to ASTM A 116, ASTM A 121, ASTM A 390, ASTM A 584, ASTM A 702 and ASTM F 626, with 1.2 ounces per square foot zinc galvanizing.

Fence heights to 12 feet shall have one-piece fabric widths.

2.4 TOP AND BOTTOM SELVAGES

Fabric with 2 inch mesh and up to 60 inches high shall be knuckled on both top and bottom selvages, over if 60 inches high, it shall be twisted and barbed on the top selvage and knuckled on the bottom selvage.

2.5 LINE POSTS

Minimum acceptable line posts shall be as follows:

Over 6-feet high:

2.0 inch O.D. pipe weighing 3.65 pounds per linear foot.

2.6 END, CORNER, AND PULL POSTS

Minimum acceptable end, corner, and pull posts shall be as follows:

Over 6 feet high:

Grade A: 2.875 inch O.D. pipe weighing 5.79 pounds per linear foot.

2.7 TOP RAIL

Rails shall be a minimum of 1.660 inches O.D. pipe Grade A weighing 2.27 pounds per linear foot. Expansion couplings 6-inches long shall be provided at each joint in top rails.

2.8 CENTER RAILS BETWEEN LINE POSTS

For fencing over 6-feet high, center rails shall be 1.660 inches O.D. pipe Grade A weighing 2.27 pounds per linear foot.

2.9 POST-BRACE ASSEMBLY

Bracing shall consist of 1.660 inches O.D. pipe Grade A weighing 2.27 pounds per linear foot and 3/8 inch adjustable truss rods and turnbuckles.

2.10 TENSION WIRE

Wire shall be galvanized, No. 7-gage, coiled spring wire, provided at the bottom of the fabric only. Zinc Coating shall weigh not less than 1.6 ounces per square foot.

2.11 STRETCHER BARS

Bars shall be one-piece lengths equal to the full height of the fabric with a minimum cross section of 3/16 by 3/4 inch, in accordance with ASTM A 116, ASTM A 121, ASTM A 390, ASTM A 584, ASTM A 702 and ASTM F 626.

2.12 POST TOPS

Tops shall be steel, wrought iron, or malleable iron designed as a weathertight closure cap. One cap shall be provided for each post, unless equal protection is provided by a combination post-cap and barbed-wire supporting arm. Caps shall have an opening to permit through passage of the top rail.

2.13 STRETCHER BAR BANDS

Bar bands for securing stretcher bars to posts shall be steel, wrought iron, or malleable iron spaced not over 15 inches on center. Bands may also be used in conjunction with special fittings for securing rails to posts. Bands shall have projecting edges chamfered or eased.

2.14 GATE POSTS

Contractor shall provide a gate post for supporting each gate leaf as follows:

Over 6 feet wide and up to 13 feet wide:

2.875 inch O.D. pipe Grade A weighing 5.79 pounds per linear foot.

2.15 GATES

For gate leaves over 6 feet high or 6 feet wide, perimeter gate frames shall be 1.90 inch O.D. pipe Grade A weighing 2.72 pounds per linear foot.

Gate frame assembly shall be welded or assembled with special malleable or pressed-steel fittings and rivets to provide rigid connections. Fabric shall be installed with stretcher bars at vertical edges; stretcher bars may also be used at top and bottom edges. Stretcher bars and fabric shall be attached to gate frames on all sides at intervals not exceeding 15 inches. Hardware shall be attached with rivets or by other means that will provide equal security against breakage or removal.

Diagonal cross-bracing, consisting of 3/8-inch diameter adjustable-length truss rods on welded gate frames, shall be provided where necessary to obtain frame rigidity without sag or twist. Nonwelded gate frames shall have diagonal bracing.

2.16 GATE HARDWARE AND ACCESSORIES

Gate hardware and accessories shall conform to ASTM A 116, ASTM A 121, ASTM A 390, ASTM A 584, ASTM A 702, ASTM F 626, and be as specified:

Hinges shall be malleable iron, forged steel, or pressed steel to suit gate size, non-lift-off type, offset to permit 180-degree opening.

Latch shall permit operation from either side of the gate, with a padlock eye provided as an integral part of the latch.

Stops and holders of malleable iron shall be provided for vehicular gates. Stops shall automatically engage the gate and hold it in the open position until manually released.

Double gates shall be provided with a cane bolt and ground-set keeper, with latch or locking device and padlock eye designed as an integral part.

2.17 MISCELLANEOUS HARDWARE

Miscellaneous hardware shall be provided as required and shall be hot-dip galvanized.

2.18 WIRE TIES

Wires for tying fabric to line posts shall be 16-gage galvanized steel wire spaced 12 inches on center. For tying fabric to rails and braces, wire ties shall be spaced 24 inches on center. For tying fabric to tension

wire, 0.105-inch hog rings shall be spaced 24 inches on center.

Manufacturer's standard procedure will be accepted if of equal strength and durability.

2.19 CONCRETE

Concrete shall conform to ASTM C 94/C 94M. Mix shall be designed to obtain concrete with a minimum 28-day compressive strength of 2,500 psi.

PART 3 EXECUTION

3.1 GENERAL

Fencing installation shall not begin before the final grading has been completed and finish elevations have been established, unless otherwise approved.

3.2 EXCAVATION

Excavations for post footings shall be drilled holes in virgin or compacted soil, of minimum sizes as indicated.

Footings shall be spaced for line posts 10 feet on center maximum and at closer intervals when indicated.

Bottoms of the holes shall be approximately 3-inches below the bottoms of the posts. Bottom of each post shall be set not less than 36-inches below finished grade when in firm, undisturbed soil. Posts shall be set deeper, as required, in soft and problem soils and for heavy, lateral loads.

Soil from excavations shall be removed from Government property.

When solid rock is encountered near the surface, the Contractor shall drill into the rock at least 12 inches for line posts and at least 18 inches for end, pull, corner, and gate posts. Holes shall be drilled at least 1 inch greater in diameter than the largest dimension of the placed post.

If solid rock is below the soil overburden, Contractor shall drill to the full depth required except that penetration into rock need not exceed the minimum depths specified above.

3.3 SETTING POSTS

Loose and foreign materials shall be removed from holes and the soil moistened prior to placing concrete.

Tops of footings shall be trowel finished and sloped or domed to shed water away from posts. Hold-open devices, sleeves, and other accessories shall be set in concrete.

Exposed concrete shall be kept moist for at least 7 calendar days after placement or cured with a membrane curing material, as approved.

Posts set in concrete construction shall be set vertically, with tops aligned and held in position until concrete has set.

3.4 CONCRETE STRENGTH

Concrete shall have attained at least 75 percent of its minimum 28-day compressive strength, but in no case sooner than 7 calendar days after placement, before rails, tension wires, barbed wire, or fabric are installed. Fabric and wires shall not be stretched or gates hung until the concrete has attained its full design strength.

Samples and test concrete shall be taken to determine strength as specified in Section 03305, "Cast-In-Place Concrete (Short Section)."

3.5 TOP RAILS

Top rails shall run continuously through post caps or extension arms, bending to radius for curved runs. Expansion couplings shall be provided as recommended by the fencing manufacturer.

3.6 BRACE ASSEMBLY

Contractor shall provide bracing assemblies at end and gate posts and at both sides of corner and pull posts, with the horizontal brace located at midheight of the fabric.

Brace assemblies shall be installed so posts are plumb when the diagonal rod is under proper tension.

Two complete brace assemblies shall be provided at corner and pull posts where required for stiffness and as indicated.

3.7 TENSION WIRE INSTALLATION

Tension wires shall be installed by weaving them through the fabric and tying them to each post with not less than 7-gage galvanized wire or by securing the wire to the fabric with 10-gage ties or clips spaced 24 inches on center.

3.8 FABRIC INSTALLATION

Fabric shall be provided in single lengths between stretch bars with bottom barbs placed approximately 1-1/2-inches above the ground line. Fabric shall be pulled taut and tied to posts, rails, and tension wires with wire ties and bands.

Fabric shall be installed on the security side of fence, unless otherwise directed.

Fabric shall remain under tension after the pulling force is released.

3.9 STRETCHER BAR INSTALLATION

Stretcher bars shall be threaded through or clamped to fabric 4 inches on

center and secured to posts with metal bands spaced 15 inches on center.

3.10 GATE INSTALLATION

Gates shall be installed plumb, level, and secure, with full opening without interference. Ground-set items shall be installed in concrete for anchorage as recommended by the fence manufacturer. Hardware shall be adjusted for smooth operation and lubricated where necessary.

3.11 TIE WIRES

Tie wires shall be U-shaped to the pipe diameters to which attached. Ends of tie wires shall be twisted not less than two full turns and bent so as not to present a hazard.

3.12 FASTENERS

Nuts for tension bands and hardware shall be installed on the side of the fence opposite the fabric side. Ends of bolts shall be peened to prevent removal of nuts.

3.13 ZINC-COATING REPAIR

Galvanized surfaces damaged by welding or abrasions, and cut ends of fabric, barbed wire, or other cut sections shall be cleaned and repaired with specified galvanizing repair material applied in strict conformance with the manufacturer's printed instructions.

3.14 TOLERANCES

Posts shall be straight and plumb within a vertical tolerance of 1/4 inch after the fabric has been stretched. Fencing and gates shall be true to line with no more than 1/2 inch deviation from the established centerline between line posts. Defects shall be repaired as directed.

-- End of Section --

SECTION 02831

VINYL FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

This Section includes the following:

- Polyvinyl chloride (PVC) fence.
- PVC fence accessories.
- PVC gates, accessories, and hardware.

1.2 SUBMITTALS

Hi-lite all descriptive literature to accomplish identification of specific components/items which are proposed to be furnished. Government will not react to descriptive material/literature which has not been hi-lited, except to reject the Submittal.

Product data in the form of manufacturer's technical data, specifications, and installation instructions for fence and gate posts, gates, and accessories.

Shop drawings showing location of fence, gates, each post, and details of post installation, extension arms, gate swing, hardware, and accessories.

Samples for initial selection of PVC color to be manufacturer's color charts or 6-inch lengths of actual fence material showing colors available.

Samples of brackets used to attach vinyl fence rail to CMU columns.

Samples for verification of PVC color to be 6-inch lengths of actual fence material to be used in color selected.

Include similar samples of polymer coating applied on posts, rails, and accessories in color selected.

1.3 QUALITY ASSURANCE

Installer Qualifications: Engage an experienced Installer who has at least three years' experience and has completed at least five vinyl fence projects with same material and of similar scope to that indicated for this Project with a successful construction record of in-service performance.

Single-Source Responsibility: Obtain vinyl fences and gates, including accessories, fittings, and fastenings, from a single source.

Fence materials and appearance to match existing fence.

1.4 PROJECT CONDITIONS

Field Measurements: Verify layout information for fences and gates shown on the Drawings in relation to the property survey and existing structures. Verify dimensions by field measurements.

PART 2 PRODUCTS

2.1 MANUFACTURER

Subject to compliance with requirements, provide vinyl fence products by one of the following or an equal approved by Contracting Officer.

Kroy-Imperial, color to be tan.

2.2 MATERIALS AND MANUFACTURING

The rigid poly (vinyl chloride) (PVC) plastic compound used to make exterior-profile extrusions meeting the requirements of this specification are categorized by the cell class requirements as defined in Specification D 1784.

Virgin PVC compounds used for the products meeting this specification shall meet cell class 12333 as defined in D 1784. Compounds that have higher cell classification because one or more properties are superior to those in this specified compound are acceptable.

Rework Material: Clean rework material, generated by the manufacturer's own manufacturing operation, may be used by the same manufacturer's fence profile production facility, provided rework materials meet all the requirements of this specification.

Recycle Materials: No recycle materials may be used in production of fence profiles. This includes, but is not limited to, off-specification PVC compound as well as rework, regrind, or scrap material generated outside the manufacturer's fence profile production facility.

Coextruded Extrusion Requirements: Only Virgin compound shall be used in the capstock strata or exposed areas of the product, excluding cut ends of the profile lengths.

2.3 WORKMANSHIP

The fencing profiles shall be free from visible cracks, holes, foreign inclusions, or other defects. The fencing profiles shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

2.4 CONDITIONING AND TEST CONDITIONS

Specimens to be tested at 73.4 deg. F. 3.6 deg. F. shall be conditioned in accordance to Methods D 618 in air in a temperature/humidity controlled chamber at 73.4 deg. 3.6 deg. F.. for no less than 4 hours.

Specimens to be tested at 32 deg. F. 3.6 deg. F shall be conditioned in

accordance with Methods D 618 in a refrigerated chamber with circulating air flow for no less than 4 hours or in an ice water bath for no less than 1 hour before testing. Samples which must be removed from the freezing temperature conditioning environment to a warmer environment should be tested within 15 seconds after removal to preclude warming of the specimen.

Sampling: The selection of sample or samples of fence profiles shall be as agreed upon between purchaser and seller. In the absence of any prior agreement, any sampling plan selected by the testing laboratory shall be deemed adequate.

Sample Marking: Samples being tested at a test laboratory not at the manufacturer's location shall be marked with a verifiable and permanent marking which shall identify the manufacturer.

Length: With the sample laying on a flat surface, measure length to the nearest 1/6 inch with a steel tape. The average of three samples shall be within 1/4 inch of the published length with no single sample deviating more than 3/8 inch from the nominal length.

Height and Width: Lay three samples on a flat surface and measure each to the nearest 1/6 inch with a steel tape or vernier calipers. The average of the three samples shall be within 1/16 inch of the nominal height and width with no single sample deviating more than 3/32 inch from the nominal height and width.

Flattening: Flatten three specimens of the fence profiles, each 2 inches long, in a suitable press between parallel plates until the distance between the plates is 40 percent of the width of the profile. In a rectangular profile, the minor axis dimension shall be the dimension which determines the compression distance. The rate of loading shall be uniform and such that the compression is completed within 2 to 5 min. On removal of the load, examine the specimens for evidence of splitting, cracking or breaking. A split or crack longer than 1/32 inch constitutes a failure of the test.

Conditioning: The conditioning and test of the flattening test specimens shall be done at 73.4 deg. F. +/- 3.6 deg. F.

Impact Resistance: Condition ten specimens, each 6 inches long, at either 73.4 deg. F. 3.6 deg. F. or 32 deg. F. +/- 3.6 deg. F. and test with the apparatus described in D2444, using a "B" tup and a "3" flat plates holder to the values in 7.4. Seven of ten specimens must pass at whichever test conditioning temperature is used. Specimens shall be temperature conditioned per Section 8.2. Shattering, splitting, or cracking greater than 1/32 inch in length shall constitute a failure.

Retest: Should more than 3 specimens fail the initial impact test, select and condition ten more samples and test per 4. If 14 or more samples pass from the combined two samplings, the last shall pass. If 7 or more specimens fail, sampling and testing should be conducted backward through the production run until it can be established that the balance of the production run will pass impact testing. The deficient portion of the production run should be discarded.

Warp: Warp should be determined when all sides of the specimen are at the same temperature. Place a full length specimen on a flat surface alongside a straight edge which is at least as long as the specimen. Measure any space between the specimen and the straight edge to the nearest 1/6 inch.

Note 5: Testing in accordance with this section is intended to be done as quality control testing to be done at the time of manufacturer to ensure conformance with this standard. Testing performed on profiles after prolonged storage, shipment, or installation may produce results at variance with the values determined at the time of manufacture.

2.5 RETEST AND REJECTION

If the results of any test(s) do not meet the requirements of this specification, the test(s) may be conducted again in accordance with an agreement between the purchaser and the seller. There shall be no agreement to lower the minimum requirement of the specification by such means as omitting tests that are a part of the specification, substituting or modifying a test method, or by changing the specification limits. In retesting, the product requirements of this specification shall be met, and the test methods designated in the specification shall be followed. If, upon retest, failure occurs, the quantity of product represented by the test(s) shall be rejected.

2.6 ACCESSORIES TEST

Test methods and values for all PVC profile accessories such as caps, plugs, and rail mounting devices may or may not be available from the manufacturer and are subject to agreement between the purchaser and the seller.

2.7 FITTINGS AND ACCESSORIES

Material: Comply with ASTM F 626. Mill-finished aluminum or galvanized iron or steel to suit manufacturer's standards.

Steel and Iron: Unless specified otherwise, hot-dip galvanize pressed steel or cast-iron fence fittings and accessories with at least 1.2 oz. zinc per sq. ft. as determined by ASTM A 90.

Aluminum: Die cast conforming to ASTM B 26, aluminum-alloy 360 or sand cast conforming to ASTM B 85, aluminum-alloy 365, ZG61A, or Tenzalloy.

Supplemental Color Coating: In addition to above metallic coatings, provide a 10-mil minimum polyvinyl chloride (PVC) plastic resin finish applied to exterior surfaces and, except inside cap shapes, to exposed interior surfaces. Color to match PVC fence.

Post and Line Caps: Provide PVC weathertight closure cap for each post.

2.8 GATES

Fabrication:

Fabricate perimeter frames of gates from same material and finish as

fence framework. Assemble gate frames according to manufacturer's details.

Gate Hardware: Provide galvanized hardware and accessories for each gate according to the following:

Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180-degree gate opening. Provide 1-1/2 pair of hinges for each leaf over 6-foot nominal height.

Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as an integral part of latch.

PART 3 EXECUTION

3.1 FENCE INSTALLATION

General: Install fence to comply with ASTM F 567 and manufacturer's instructions. Do not begin installation and erection before final grading is completed, unless otherwise permitted.

3.2 GATE INSTALLATION

Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary. Install gates according to manufacturer's instructions, plumb, level, and secure.

-- End of Section --

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SECTION 02870

SITE FURNISHINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2002) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A 153/A 153M (2003) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 307 (2002) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

ASTM A 53/A 53M (2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Bicycle Racks

Manufacturer's descriptive data and catalog cuts.

SD-04 Samples

Finish; G.

Four sets of color data for each furnishing displaying manufacturer's color selections and finishes, and identifying those colors and finishes proposed for use.

SD-06 Test Reports

Recycled Materials

A report of site furnishing parts consisting of recycled

materials. Product specification data, providing test information for deflection and creep in accordance with ASTM D 648 and ASTM D 2990 for site furnishings which use plastic lumber as a component, shall be submitted. The data shall provide a comparison of deflection and creep measurements to other comparable materials.

Testing

A report of post-installation test results.

SD-07 Certificates

Primer certificate
Powder coatings certificate

Manufacturer's certificate of compliance.

1.3 DELIVERY, INSPECTION, STORAGE AND PROTECTION

Materials shall be delivered, handled, and stored in accordance with the manufacturer's recommendations. Site furnishings shall be inspected upon arrival at the job site for conformity to specifications and quality in accordance with paragraph MATERIALS. Protect from corrosion, staining, and other types of damage. Store items in designated area free from contact with soil and weather. Remove and replace damaged items with new items.

1.4 GENERAL REQUIREMENTS

11.4.1 Installation Drawings

Submit templates, erection and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation.

1.4.2 Assembly Instruction Drawings

Submit assembly instruction drawings showing layout(s), connections, bolting and anchoring details as per manufacturer's standards.

1.4.3 Powder Coatings Certificate

Submit a certificate from the manufacturer stating that the powder coat conforms to ASTM D 3451.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall be the standard products of a manufacturer regularly engaged in the manufacture of such products. The materials provided shall be of a type with proven satisfactory usage for at least 2 years.

2.1.1 Anchors and Hardware

Anchors shall be provided, where necessary, for fastening site furnishings securely in place and in accordance with approved manufacturer's instructions. Anchoring devices that may be used, when no anchors are otherwise specified or indicated, include anchor bolts, slotted inserts, expansion shields for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; and lag bolts and screws for wood. Anchor bolts shall conform to ASTM A 307. Hardware shall be stainless steel in accordance with ASTM A 153/A 153M and compatible with the material to which applied. All exposed hardware shall match in color and finish. Mounting hardware shall be concealed, recessed, and plugged.

2.2 COATINGS AND FINISHES

2.2.1 Polyester Powder

Powder-coated surfaces shall receive electrostatic zinc coating prior to painting. Powder coating shall be electrostatically applied and oven cured. Polyester powder coating shall be resistant to ultraviolet (UV) light.

2.2.2 Finish

Finish shall be as specified by the manufacturer or as indicated. Exposed surfaces and edges shall be rounded, polished, or sanded. Finish shall be non-toxic, non-glare, and resistant to corrosion. Exposed surfaces shall be smooth and splinter-free exposed surfaces.

2.3 BICYCLE RACKS

Design bicycle racks (stanchions) in accordance with manufacturer's standards and to meet design conditions indicated. Locate as shown on the drawings. Provide powder coat finish in color as selected from manufacturer's standards. Racks shall accommodate locking devices and secure, as a minimum, one wheel and part of the frame simultaneously. The spacing between racks shall be a minimum of 24 inches.

2.3.1 Metal Pipe Bicycle Racks

Provide ASTM A 53/A 53M schedule 40 steel pipe bicycle racks in configuration and of 4 1/2 inch pipe size. Type of mounting, bicycle rack capacity and height above the ground as shown on the drawings.

PART 3 EXECUTION

3.1 INSTALLATION

The Contractor shall verify that finished grades and other operations affecting mounting surfaces have been completed prior to the installation of site furnishings. Site furnishings shall be installed plumb and true, at locations indicated, in accordance with the approved manufacturer's instructions.

3.1.1 Assembly and Erection of Components

Items shall be shipped knocked-down (KD) ready for site assembly. Packaged components shall be complete including all accessories and hardware. New parts shall be acquired from the manufacturer; substitute parts will not be accepted unless approved by the manufacturer. When the inspection of parts has been completed, the site furnishings shall be assembled and anchored according to manufacturer's instructions or as indicated. When site furnishings are assembled at the site, assembly shall not interfere with other operations or pedestrian and vehicular circulation.

3.1.2 Anchorage, Fastenings, and Connections

Furnish metal work, mounting bolts or hardware in ample time for securing into concrete or masonry as the work progresses. Provide anchorage where necessary for fastening furniture or furnishings securely in place. Provide, for anchorage not otherwise specified or indicated, slotted inserts, expansion shields, and power-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish the fastenings to which they are applied. Conceal fastenings where practicable.

3.2 WELDING

Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1/D1.1M. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

3.3 TESTING

Each site furnishing shall be tested to determine a secure and correct installation. A correct installation shall be according to the manufacturer's recommendations and by the following procedure: The Contractor shall measure the physical dimensions and clearance of each installed site furnishing for compliance with manufacturer's recommendations and as indicated. Site furnishings which do not comply shall be reinstalled. Fasteners and anchors determined to be non-compliant shall be replaced. A written report describing the results of the testing shall be provided.

3.4 BOLLARDS

Install in pipe sleeves embedded in concrete and filled with non-shrink grout or quick setting anchoring cement.

3.5 BICYCLE RACKS

Affix to base structure by flanges anchored to concrete or other existing masonry by expansion shields. Provide Series 300 stainless steel bolts to anchor aluminum alloy flanges, of a size appropriate to the standard product of the manufacturer. Where aluminum or alloy fittings or extrusions are to be in contact with dissimilar metals or concrete, give the contact surface a heavy coating of bituminous paint.

-- End of Section --

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SECTION 02920

LAWNS AND GRASSES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 92 (2003) Wire-Cloth Sieves for Testing
Purposes

ASTM INTERNATIONAL (ASTM)

ASTM C 602 (1995; R 2001) Agricultural Liming
Materials

ASTM D 2028 (1997; R 2004) Standard Specification for
Cutback Asphalt (Rapid-Curing Type)

ASTM D 2399 (1983; R 1999) Standard Practice for
Selection of Cutback Asphalts

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330,
"Submittal Procedures," in sufficient detail to show full compliance with
the specification:

SD-09 Manufacturer's Field Reports

Laboratory analysis of Grass Seed for percent pure, percent
germination, and percent weed seed, along with laboratory analysis
of proposed Top Soil shall be submitted.

1.3 SAMPLING AND TESTING

Sampling and testing of grass seed and topsoil shall be by an approved
testing service and show compliance with all specified requirements.

1.4 DELIVERY AND STORAGE

1.4.1 Seed and Fertilizer

Grass seed and fertilizer shall be delivered in sealed containers or bags,
each labeled in accordance with the applicable federal and state
regulations and bearing the name, trade name or trademark, and
certification of the producer.

Packaged materials shall be stored off the ground, under watertight cover, and away from damp surfaces.

1.4.2 Sod Delivery

Dumping from vehicles will not be permitted. If stacked during transit or storage, the sod shall be placed roots to roots or grass to grass. During delivery and while in stacks, sod shall be kept moist and cool, and protected from sun, air, and freezing.

1.5 WEATHER LIMITATIONS

Topsoil shall not be placed when the subgrade is frozen, excessively wet or in a condition detrimental to grass seed planting or finish grading. Sodding shall be performed between April and September.

Seeding shall be done between April and May.

PART 2 PRODUCTS

2.1 TOPSOIL

Topsoil previously removed and stockpiled shall be used in the work. Topsoil shall be free from subsoil, litter, and other objectionable material.

Topsoil shall be fertile, friable, natural surface soil obtained from well-drained areas and possessing characteristics of representative soils in the project vicinity that produce heavy growths of crops, grass, or other vegetation. Topsoil shall be free of material that might be harmful to plant growth or hindrances to planting or maintenance operations.

Chemical and physical properties of topsoil proposed for use in the work shall be as follows:

Organic matter shall be at least 6 percent as determined by loss on ignition of moisture-free samples of topsoil.

The pH range shall be from 5.0 to 7.0.

The physical analysis of the topsoil shall be within the following limits: (AASHTO M 92)

<u>SIEVE SIZE</u>	<u>PERCENT PASSING</u>
1/4 inch	97 to 99

2.2 TOPSOIL BLEND

Where insufficient topsoil is removed from the project site, the topsoil removed shall be stockpiled and blended with compost at the site to achieve the required volume.

2.3 GRASS SEED

Grass seed for field grass areas shall be same as existing grass having not less than 90 percent germination. Weed seed shall be not more than 0.5 percent by weight of the total grass seed mixture.

Grass seed which has become wet, moldy, or otherwise damaged in transit or storage will not be acceptable.

2.4 SOD

Sod shall be well matted with live grass roots. Sod shall be sufficiently thick to hold together during handling operations and to obtain a satisfactory growth of grass. Sod shall be live, fresh, and uninjured at the time of planting and it shall be the Contractor's responsibility to ensure that it contains sufficient moisture at planting to produce growth. Before the sod is harvested, the grass shall be mowed to the average height normally maintained for that variety of grass and shall have all clippings removed. Presence of weeds or other material which might be detrimental to the proposed planting will be cause for rejection of sod.

Rectangular sections used for sodding may vary in length but shall be of equal width and of a size that will permit lifting on boards or that can be otherwise handled without breaking and without loss of native soil attached to the roots.

2.5 LIME

Lime shall be agricultural ground limestone having a calcium-carbonate equivalent of not less than 80 percent, ground to such fineness that at least 99 percent will pass through a No. 8 sieve and at least 75 percent will pass through a No. 60 sieve, and meet the requirements of ASTM C 602, agricultural limestone Class Designation T.

2.6 FERTILIZER

Fertilizer shall be applied to amend soils as recommended by Soils Report.

2.7 MULCH

Mulch shall be salt or bahia hay or threshed straw of wheat, rye, oats, or barley and shall be clean and free of seeds.

Mulch that is fresh and excessively brittle or that is in such an advanced stage of decomposition as to smother or retard the growth of grass will not be acceptable.

2.8 ASPHALT EMULSION

Asphalt emulsion shall meet the requirements of ASTM D 2028 or ASTM D 2399.

PART 3 EXECUTION

3.1 TOPSOIL PREPARATION

3.1.1 Subgrade

Before topsoil is placed, the subgrade surface shall be cleared of all materials that might hinder the performance of the work or subsequent maintenance operations.

3.1.2 Grading

Grades on areas that have been previously established shall be maintained in a true and even condition.

Where grades have not been established and where improperly graded, areas shall be uniformly graded. Finished surfaces shall be smooth within a tolerance of 0.1-foot above or below the indicated subgrade elevations, with uniform levels or slopes between the points where elevations are indicated or between such points and existing grades and free from irregular surface changes to prevent the formation of depressions where water will accumulate.

3.1.3 Tillage

Immediately prior to placing the topsoil, the subgrade, wherever excessively compacted by traffic or other cause, shall be loosened to a depth of at least 3 inches by plowing, discing, harrowing, or other approved means.

3.1.4 Placing Topsoil

Topsoil shall be uniformly distributed and evenly spread to an average thickness of 6 inches. Spreading shall be performed in such a manner that planting can proceed with little additional soil preparation or tillage, and the area shall be left smooth and suitable for lawns. Irregularities in the surface from topsoiling or other operations shall be corrected so as to prevent the formation of depressions where water will stand. Topsoil shall not be hauled and placed when wet or when the subgrade is frozen, excessively wet or in a condition otherwise detrimental to the proposed planting or to proper grading. Topsoil shall be spread uniformly but shall not be compacted. Where any portion of the surface becomes gullied or otherwise damaged, the affected area shall be repaired to establish the condition and grade prior to topsoiling, and then shall be re-topsoiled.

3.1.5 Application of Fertilizer

Fertilizer shall be uniformly distributed over the topsoil surface, and incorporated into the topsoil to a depth of at least 1 inch by discing, harrowing, or other approved means.

3.1.6 Smooth Grading

Undulations or irregularities in the topsoil surface resulting from operations shall be leveled.

Topsoil surface shall be made smooth and uniform.

3.1.7 Cleanup

After smooth grading, the topsoil surface shall be cleared of stones or other objects that might be a hindrance to planting or maintenance operations.

Topsoil or other material that has been brought upon the surfacing of paved areas by operations shall be removed daily.

3.2 SEEDING

3.2.1 Method of Sowing

Seeding, making use of a mixture of seed, fertilizer, and water applied by special mobile equipment designed for the purpose, may be employed subject to approval. When the above method of seeding is employed, covering seed and compaction operations specified will be waived.

3.2.2 Preparation of Seedbed

Seedbed shall be loose and porous at the time of seeding. When necessary, the seedbed shall be loosened to a depth of at least 3 inch by harrowing or other suitable means and the surface smooth-graded and cleared of objectionable material as specified.

3.2.3 Planting Seed

Grass seed shall be uniformly distributed over the prepared seed bed.

For field grass areas, the rate of seeding shall be as recommended by seed grower. Hydro-seeding can be used as approved by Contracting Officer.

Immediately after seed planting, the area shall be lightly raked or lightly harrowed to cover the seed to an average depth of 1/4 inch.

3.2.4 Compacting

Immediately after the completion of seeding operations and raking, the entire area shall be compacted by means of suitable compacting equipment.

Compacting equipment shall consist of approved equipment weighing 60 to 90 pounds per linear foot of roller width and shall be suitable for the soil material being compacted. Wheels of pneumatic-tired rollers shall be so spaced that one pass of the roller will accomplish complete coverage equal to the rolling width of the equipment.

3.3 MULCHING

3.3.1 Placing Mulch

Mulch shall be spread by hand or approved equipment. Mulching shall be started at the windward side of relatively flat areas, at the upper part of steep slopes, and shall continue uniformly until the area is completely

covered.

3.3.2 Anchoring Mulch with Asphalt Emulsion

Mulch shall be anchored in place by a spray coating of asphalt emulsion uniformly applied at the rate of 10 to 13 gallons per 1,000 square feet. Precautions shall be taken to prevent the asphalt emulsion from damaging or disfiguring structures and other property on or adjacent to the mulched area.

3.4 SODDING

3.4.1 General

After the sod has been harvested, it shall be delivered to the site and laid in place within 48 hours. Any sod that has been damaged by handling or storage, turned yellow or shows definite indications of dying, will be rejected.

3.4.2 Solid Sodding

Sod shall be laid smoothly, edge to edge, and with staggered joints. Sod shall immediately be pressed firmly into contact with the sod bed by tamping or rolling with approved equipment, to eliminate all air pockets, provide a true and even surface, and ensure knitting without displacement of the sod or deformation of the surfaces of sodded areas. Any excess soil accumulated from handling of the sod shall be used to fill voids or cracks between the sections of sod.

3.5 GRASS ESTABLISHMENT

3.5.1 General

The period of grass establishment shall begin immediately after the completion of mulching in an area and shall continue for a period of 2-months after the completion of seeding on the entire project unless the desired grass cover is established in a shorter period of time and shortening of the grass-establishment period is authorized.

3.5.2 Watering

Contractor shall provide and maintain temporary piping and lawn-watering equipment required to convey water from the water source to uniformly water the seeded areas. Water shall be free from substances detrimental to the growth of vegetation. Water sources located on Government property will be subject to approval prior to use. Temporary watering equipment shall be removed after grass area acceptance.

Watering schedules shall be arranged and lawn-watering equipment laid out in a manner to avoid the necessity of walking over muddy and newly seeded areas.

Watering shall be done in a manner to prevent the displacement of seed and mulch and to prevent puddling and water erosion.

Immediately after the completion of mulching in an area, the area shall be moistened to a depth of 3 inches or more.

After the initial watering, the seeded areas shall be watered as required to maintain the soil in a moist condition for the entire grass-establishment period.

3.5.3 Mowing

When the average height of grass reaches 8 inches or when the grass growth tends to smother the seedlings, seeded field-grass areas shall be mowed with approved mowing equipment to a grass height of 4 inches.

3.5.4 Weeding

Weeds or other undesirable vegetation that threaten to smother the grass shall be uprooted and removed from the area.

3.5.5 Refertilizing

After the first mowing and during a period when the grass is dry, fertilizer shall be uniformly distributed over the seeded area at a rate of 2 pounds of actual nitrogen per 1,000 square feet. Fertilizer shall be as specified.

3.5.6 Reseeding

After the first mowing, bare areas shall be reseeded.

Reseeding shall be with the grass seed specified for each seeded area and shall be sown at the rate specified and in a manner that will cause a minimum of disturbance to the existing stand of grass and mulch.

3.5.7 Remulching

In areas where mulch has been disturbed sufficiently to nullify its purpose, new mulch shall be added and anchored as specified.

3.5.8 Resodding

The area on which an acceptable stand of grass is not present shall be sodded as specified for the original planting. An acceptable stand is living grass from at least 90 percent of the sod placed according to this specification. Areas on which there is not an acceptable stand of grass shall continue to be replanted throughout the maintenance period until an acceptable stand of grass is present.

3.6 ACCEPTANCE PROVISIONS

3.6.1 Acceptance Requirements

Completed grass areas shall have been recently mowed and be covered with a uniform stand of the specified grass, be free of rank growths of weeds or

other undesirable vegetation, and be free of irregular surface changes and other depressions where water will accumulate.

Scattered bare spots not larger than 6 inches in any dimension will be allowed, up to a maximum of 3 percent of any grass area.

Condition of grass areas at the time of inspection will be noted and a determination, made whether the grass-establishment period shall be extended for any area.

3.6.2 Repairs

If, before completion and acceptance of the entire work, portions of the surface become gullied or otherwise damaged following seeding or the grass seedings have been destroyed, the affected area shall be repaired to re-establish the condition and grade of the soil prior to seeding and then re-seeded, remulched, and the grass established as specified.

3.7 PROTECTION

Seeded areas shall be protected against traffic or other use by erecting barricades around each area immediately after seeding is completed and by placing warning signs of an approved type on each seeded area.

-- End of Section --

SECTION 02921

SEEDING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 4427 (1992; R 2002e1) Peat Samples by Laboratory Testing

ASTM D 4972 (2001) pH of Soils

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act (1940; R 1988; R 1998) Federal Seed Act

DOA SSIR 42 (1996) Soil Survey Investigation Report No. 42, Soil Survey Laboratory Methods Manual, Version 3.0

1.2 DEFINITIONS

1.2.1 Stand of grass.

95 percent ground cover of the established species.

1.3 RELATED REQUIREMENTS

Section 02300 EARTHWORK, Section 02922 SODDING, Section 02930 EXTERIOR PLANTS, and Section 02935 LANDSCAPE ESTABLISHMENT applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wood cellulose fiber mulch

Fertilizer

Include physical characteristics, and recommendations.

SD-06 Test Reports

Topsoil composition tests (reports and recommendations).

SD-07 Certificates

State certification and approval for seed

SD-08 Manufacturer's Instructions

Erosion Control Materials

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Seed Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.5.1.2 Fertilizer Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer may be furnished in bulk with certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Seed, Fertilizer Storage

Store in cool, dry locations away from contaminants.

1.5.2.2 Topsoil

Prior to stockpiling topsoil, treat growing vegetation with application of appropriate specified non-selective herbicide. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

1.5.2.3 Handling

Do not drop or dump materials from vehicles.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.6.1 Restrictions

Do not plant when the ground is frozen and snow covered, muddy, or when air temperature exceeds 90 degrees Fahrenheit.

1.7 TIME LIMITATIONS

1.7.1 Seed

Apply seed within twenty four hours after seed bed preparation.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Classification

Provide State-certified seed of the latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content, and inert material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected. Field mixes will be acceptable when field mix is performed on site in the presence of the Contracting Officer.

2.1.2 Planting Dates

<u>Planting Season</u>	<u>Planting Dates</u>
Season 1	April - May
Season 2	Sept. - Oct.

2.1.3 Seed Mixture by Weight

Seed mixture to be determined by local horticulturist to match existing growth.

Proportion seed mixtures by weight. Season 2 plantings for a permanent stand of grass.

2.2 TOPSOIL

2.2.1 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph entitled "Composition." When available topsoil shall be existing surface soil stripped and stockpiled on-site in accordance with Section 02315 EXCAVATION AND FILL].

2.2.2 Off-Site Topsoil

Conform to requirements specified in paragraph entitled "Composition." Additional topsoil shall be furnished by the Contractor.

2.2.3 Composition

Containing from 5 to 10 percent organic matter as determined by the topsoil

composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH shall be tested in accordance with ASTM D 4972. Topsoil shall be free of sticks, stones, roots, and other debris and objectionable materials.

2.3 SOIL CONDITIONERS

Add conditioners to topsoil as required to bring into compliance with "composition" standard for topsoil as specified herein.

2.3.1 Peat

Natural product of peat moss derived from a freshwater site and conforming to ASTM D 4427. Shred and granulate peat to pass a 1/2 inch mesh screen and condition in storage pile for minimum 6 months after excavation.

2.3.2 Sand

Clean and free of materials harmful to plants.

2.3.3 Perlite

Horticultural grade.

2.3.4 Composted Derivatives

Ground bark, nitrolized sawdust, humus or other green wood waste material free of stones, sticks, and soil stabilized with nitrogen and having the following properties:

2.3.4.1 Particle Size

Minimum percent by weight passing:

No. 4 mesh screen	95
No. 8 mesh screen	80

2.3.4.2 Nitrogen Content

Minimum percent based on dry weight:

Fir Sawdust	0.7
Fir or Pine Bark	1.0

2.4 FERTILIZER

2.4.1 Granular Fertilizer

Synthetic, granular controlled release fertilizer containing concrete mix for soils as described by Soils Report.

2.4.2 Hydroseeding Fertilizer

Controlled release fertilizer, to use with hydroseeding and composed of pills coated with plastic resin to provide a continuous release of nutrients for at least 6 months and containing the required nutrients to provide a good growth medium for a healthy stand.

2.5 MULCH

Mulch shall be free from noxious weeds, mold, and other deleterious materials.

2.5.1 Straw

Stalks from oats, wheat, rye, barley, or rice. Furnish in air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Straw shall contain no fertile seed.

2.5.2 Hay

Air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Hay shall be sterile, containing no fertile seed.

2.5.3 Wood Cellulose Fiber Mulch

Use recovered materials of either paper-based (100 percent) or wood-based (100 percent) hydraulic mulch. Processed to contain no growth or germination-inhibiting factors and dyed an appropriate color to facilitate visual metering of materials application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 5.5 to 8.2. Use with hydraulic application of grass seed and fertilizer.

2.6 WATER

Source of water shall be approved by Contracting Officer and of suitable quality for irrigation, containing no elements toxic to plant life.

2.7 EROSION CONTROL MATERIALS

Erosion control material shall conform to the following:

2.7.1 Erosion Control Blanket

100 percent agricultural straw stitched with a degradable nettings, designed to degrade within 12 months.

2.7.2 Hydrophilic Colloids

Hydrophilic colloids shall be physiologically harmless to plant and animal life without phytotoxic agents. Colloids shall be naturally occurring, silicate powder based, and shall form a water insoluble membrane after curing. Colloids shall resist mold growth.

2.7.3 Erosion Control Material Anchors

Erosion control anchors shall be as recommended by the manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 EXTENT OF WORK

Provide soil preparation (including soil conditioners as required), fertilizing, seeding, and surface topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.1.1.1 Topsoil

Provide 4 inches of topsoil to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate fertilizer, soil conditioners into soil a minimum depth of 4 inches by disking, harrowing, tilling or other method approved by the Contracting Officer. Remove debris and stones larger than 3/4 inch in any dimension remaining on the surface after finish grading. Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.1.1.2 Soil Conditioner Application Rates

Apply soil conditioners at rates as determined by laboratory soil analysis of the soils at the job site.

3.1.1.3 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site.

3.2 SEEDING

3.2.1 Seed Application Seasons and Conditions

Immediately before seeding, restore soil to proper grade. Do not seed when ground is muddy frozen and snow covered or in an unsatisfactory condition for seeding. If special conditions exist that may warrant a variance in the above seeding dates or conditions, submit a written request to the Contracting Officer stating the special conditions and proposed variance. Apply seed within twenty four hours after seedbed preparation. Sow seed by approved sowing equipment. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing.

3.2.2 Seed Application Method

Seeding method shall be hydroseeding.

3.2.2.1 Hydroseeding

First, mix water and fiber. Wood cellulose fiber, paper fiber, or recycled

paper shall be applied as part of the hydroseeding operation. Fiber shall be added at 1,000 pounds, dry weight, per acre. Then add and mix seed and fertilizer to produce a homogeneous slurry. Seed shall be mixed to ensure broadcasting at the rate of 5 pounds per 1000 square feet. When hydraulically sprayed on the ground, material shall form a blotter like cover impregnated uniformly with grass seed. Spread with one application with no second application of mulch.

3.2.3 Mulching

3.2.3.1 Asphalt Adhesive Tackifier

Asphalt adhesive tackifier shall be sprayed at a rate between 10 to 13 gallons per 1000 square feet. Sunlight shall not be completely excluded from penetrating to the ground surface.

3.2.3.2 Non-Asphaltic Tackifier

Hydrophilic colloid shall be applied at the rate recommended by the manufacturer, using hydraulic equipment suitable for thoroughly mixing with water. A uniform mixture shall be applied over the area.

3.2.4 Watering

Start watering areas seeded as required by temperature and wind conditions.

Apply water at a rate sufficient to insure thorough wetting of soil to a depth of 2 inches without run off. During the germination process, seed is to be kept actively growing and not allowed to dry out.

-- End of Section --

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SECTION 02935

TREES, PLANTS, AND GROUND COVERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NURSERY AND LANDSCAPE ASSOCIATION (ANLA)

ANLA Z60.1 (1996) Nursery Stock

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Written Notice of Plant Deliveries shall be submitted in accordance with the paragraph entitled, "Delivery, Storage and Handling."

SD-03 Product Data

Manufacturer's catalog data for the following materials shall be submitted:

Mulch

SD-04 Samples

5 pounds of Mulch shall be submitted for inspection and approval prior to application on site.

SD-10 Operation and Maintenance Data

Prior to the end of the contract maintenance period, copies of written instructions for year-round maintenance and care of the following items shall be submitted:

Installed Trees
Installed Plants
Installed Ground Cover

1.3 QUALITY ASSURANCE

During the guarantee period, plants that die or are in an unhealthy, unsightly, or badly impaired condition shall be replaced as soon as is

reasonably possible after the unsatisfactory condition has become evident. No replacements shall be made in any season definitely unfavorable for planting. At the conclusion of the guarantee period, an inspection shall be conducted to determine the condition of plants. Plants not in a healthy growing condition will be noted. As soon as seasonal conditions permit, plants noted to be unhealthy, unsightly, or damaged shall be removed from the site and replaced with healthy plants of the same kinds and sizes as originally specified. Such replacements shall be made in the same manner as the original planting at no extra cost to the Government.

1.4 DELIVERY, STORAGE AND HANDLING

Written Notice of Plant Deliveries, in advance, shall be submitted when the plant material is to be delivered and shall indicate the manner of shipment. Contractor shall furnish an itemized list, in duplicate, of the actual quantity of plant material in each delivery. List shall include the pertinent data as indicated. This list and the necessary inspection certificates to accompany each plant or shipment shall be delivered to the Contracting Officer prior to acceptance and planting of the plant material.

1.4.1 Packing and Shipping

Plants shall be protected during delivery to prevent damage or desiccation of leaves. Trees shall be protected during transport by tying in the branches and covering exposed branches.

Material other than trees, plants, and ground cover shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis, name, and trade name or trademark. In lieu of containers, material may be furnished in bulk, and a certificate indicating the above information shall accompany each delivery.

Pesticide material, including soil fumigants, shall be delivered to the site in the original unopened containers. Containers that do not have a legible appropriate label will be rejected.

1.4.2 Storage and Protection

Plants and materials not installed or used on the day of arrival at the site shall be stored and protected as follows:

Outside storage shall be shaded and protected from the wind.

Plants, including those in containers, shall be kept in a moist condition until planted.

Fertilizer shall be kept in dry storage away from contaminants.

Soil sterilant shall be stored remote from other landscape materials.

PART 2 PRODUCTS

2.1 MATERIAL

Plant material furnished shall be nursery grown, well-branched and proportioned, particularly with respect to the width/height relationship, and shall have a fibrous root system. Plants may be inspected at the place of growth, but such inspection shall not preclude the right of rejection at the site.

2.1.1 Plants

Scientific and common names of plants indicated shall conform to the approved names given in the ANLA Z60.1 "American Standard for Nursery Stock."

Plants of kinds other than those named in the plant list will not be accepted unless specifically approved in writing. Proposed substitutes in each case must possess the same essential characteristics as the kind of plant actually specified in regard to appearance, ultimate height, shape, habit of growth, and general soil and other requirements. In no case shall the average value and quality of substituted plants be less than the value and quality of plants actually specified. Plants of greater value and quality may be accepted without additional cost to the Government.

2.1.1.1 Designation

Balled and burlapped plants designated "BB" shall be adequately balled as specified in ANLA Z60.1. Balls shall be firmly wrapped with burlap or other approved cloth. No balled plant will be acceptable if the ball is cracked or broken or if the stem is loose in the ball, either before or during the process of planting. If all other requirements are met, container-grown plants may be furnished in lieu of balled and burlapped plants.

Container-grown plants designated "C" shall have been grown in pots, cans, tubs, or boxes for a minimum of 6 months and a maximum of 2 years. Plants shall have sufficient roots to hold earth intact, without being rootbound, after removal from containers.

Plantation-grown stock shall conform to ANLA Z60.1.

2.1.2 Commercial Fertilizer

Commercial fertilizer shall be in accordance with the recommendations of the American Association of Nurserymen, uniform in composition, and delivered to the site in unopened original containers, each fully labeled, conforming to the applicable laws and bearing the trade name or trademark and warranty of the producer.

2.1.3 Mulch

Mulch shall consist of forest litter, sawdust, hay, straw, or other collected organic material. Mulches shall not contain sticks larger than 1/4 inch in diameter, stones, clay, or other foreign material that will prevent the eventual decay of the mulch. Mulch that is harvested with farm equipment shall not be used within 48 hours after the mulching material has been cut. Forest-litter mulch shall consist of not less than 50-percent

decomposed leaf litter, including 1/2 to 1 inch of the soil lying under the leaves or occurring in the natural woodland location of the leaves. When sawdust mulch is used, 7.5 pounds of ammonium sulfate or the equivalent shall be uniformly added to each cubic yard of sawdust.

2.1.4 Peat

Peat shall be a natural product of either sphagnum moss, reed, or sedge peat taken from a fresh water site. Peat shall be free from lumps, roots, and stones or other foreign matter and of such physical condition that the peat can be passed through a 1/2-inch screen and be readily incorporated with the top soil. Peat shall have been conditioned in storage piles after excavation for at least 6 months, including one freezing and thawing period. Peat shall contain not less than 90-percent organic matter by weight as determined by loss on ignition on an oven-dry basis.

2.1.5 Topsoil

Topsoil blend shall be in accordance with Section 02920, "Lawns and Grasses."

2.1.6 Trunk-Wrapping Material

Tree wrap shall be two thicknesses of crinkled paper cemented together with a layer of bituminous material. Wrapping material shall be a minimum of 4 inches in width and have a stretch factor of 33-1/3 percent. Twine for tying shall be a lightly-tarred, medium or coarse sisal yarn.

2.1.7 Guying and Staking Material

Guying wire shall be annealed galvanized steel.

Stakes for tree support shall be rough sawn wood free from defects that impair the strength. Standard stakes shall be a minimum of 2 by 2 inches or 2-1/2 inches in diameter by the length required, pointed at one end. Ground stakes shall be a minimum of 2 by 2 inches by 3-feet long, pointed at one end.

2.1.8 Water

Water shall contain no elements toxic to plant life, and if not readily available at the jobsite, shall be transported to the jobsite by a means approved by the Contracting Officer.

2.1.9 Source Quality Control

2.1.9.1 Tests/Inspection

Quality and size of plants shall be in accordance with rules and grading by the ANLA Z60.1 and included in ANLA Z60.1. Plants shall have a normal habit of growth and shall be sound, healthy, vigorous, and free from disease and insect infestations. Trees shall have single straight trunks (unless this condition is a natural state). Any tree with a weak, thin trunk not capable of supporting itself when planted in the open will not be

accepted. Plants larger in size than specified may be used, with approval, at no additional cost to the Government. If the use of larger plants is approved, the ball of earth and spread of roots shall be increased in accordance with ANLA Z60.1.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Verification of Condition

Actual planting shall be performed during periods when weather and soil conditions are suitable and in accordance with locally accepted practices (i.e. local planting season). Deviation from these requirements will be permitted only when approved in writing by the Contracting Officer.

3.2 PREPARATION

3.2.1 Protection of Planting Areas

Before excavations are made, precautionary measures shall be taken to protect existing vegetation during planting operations.

3.2.2 Surface Preparation

Locations for plants and outlines of areas to be planted shall be marked on the ground and approved before excavation is made. Shrubs shall be planted not less than 36 inches from a building unless specifically designated.

3.2.2.1 Excavation

Excavation for planting shall include stripping and stacking all acceptable topsoil encountered within the areas to be excavated for trenches, plant pits, and planting beds. Excavation shall extend to the required subgrades indicated, but in no case less than specified. Plant pits shall be circular in outline or square if machine dug and shall have vertical sides and flat bottoms. Minimum depths of plant pits shall be measured from finished grade. Planting beds in which ground cover or similar plantings are required shall be excavated to the depth shown to eliminate objectionable weeds or grasses.

3.2.2.2 Pits

Diameter or minimum width of pits shall be at least 1 foot greater than the diameter of the ball. Minimum depth of pits shall be to the top of root ball and a minimum of 6 inches of compacted topsoil blend below the ball.

3.2.2.3 Excess Soil

Acceptable excess excavated topsoil shall be used to form saucers around plants, wasted uniformly over nearby low or rough lawn areas, or disposed as approved. Excess soils not required or not suitable for the above usage shall be disposed as directed.

3.3 INSTALLATION

Plants shall be planted in pits and at such levels that, after settlement, plants will bear the same relation to the finished grade of the surrounding ground as to the grade of the ground from which plants were dug. Plants shall be set plumb and rigidly braced in position until the soil has been tamped solidly around the ball. Plants shall be planted in approved topsoil blend which shall be settled by watering and tamping. To compensate for shrinkage, the finished grade of the topsoil blend prior to watering shall be fixed at an elevation that is 10 percent of the fill depth higher than the desired finished grade. To facilitate watering, a shallow saucer approximately 3-inches deep shall be formed around each plant by placing a ridge of topsoil blend around the edge of each filled-in pit.

Balled and burlapped (BB) plants shall be placed on a minimum of 6 inches of compacted topsoil blend that has been hand-tamped prior to placing plants. Plants shall then be placed in the plant pit and the topsoil blend tamped to fill all voids under the base and around the ball to a height of one-half the depth of the ball. Cloth, ropes, wires, and other wrapping material shall be cut away from the top half of the ball, and backfilling shall be completed. In no case shall cloth be pulled out from under the ball.

Containers shall be opened and the plants carefully removed so that the earth around the roots of the plants remains unbroken. Plants shall be placed on a minimum of 6 inches of compacted topsoil blend that has been hand-tamped prior to placing plants. Plants shall be placed in the plant pit and the topsoil blend tamped to fill all voids under the base and around the ball to the full depth of the ball.

3.4 APPLICATION

3.4.1 Pruning

Pruning shall be limited to the minimum necessary to remove injured twigs and branches and to compensate for the loss of roots during transplanting, but must never exceed one-half of the branching structure. With approval, pruning may be done before the delivery of plants but not before plants have been inspected and approved. Cuts shall be made flush, leaving no stubs. Cuts over 3/4 inch in diameter shall be painted with an approved tree-wound paint. To further aid in the recovery of transplanted trees, the leaves may be stripped prior to shipment where this is a locally accepted practice and approved. Evergreens shall not be pruned except to remove injured branches.

3.4.2 Mulching

Within 2 calendar days after planting, plants shall be mulched with a layer of mulch material covering the entire saucer area around each plant to a depth of 2 to 3 inches. Peat used as the mulch material shall be saturated and incorporated into the top 2 inches of the soil.

3.4.3 Watering

During the planting period, and for 2 weeks thereafter, plants shall be watered by the Contractor in accordance with the needs of the species, and as required by the individual plant.

3.5 SCHEDULES

Maintenance operations for Installed Trees, Installed Plants and Installed Ground Cover shall begin immediately after planting and shall continue as required until final acceptance. Plants shall be kept in a healthy, growing condition by necessary maintenance. Plants shall be inspected at least once per week and needed maintenance performed promptly.

-- End of Section --

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SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ACI INTERNATIONAL (ACI)

ACI 117	(1990) Standard Specification for Tolerances for Concrete Construction and Materials
ACI 301	(1999) Specifications for Structural Concrete
ACI 304R	(2000) Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 315	(1992) Details and Detailing of Concrete Reinforcement
ACI 318/318R	(2002) Building Code Requirements for Structural Concrete and Commentary

ASTM INTERNATIONAL (ASTM)

ASTM A 615/A 615M	(2003a) Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 138/C 138M	(2001a) Standard Test Method for Density ("Unit Weight"), Yield, and Air Content (Gravimetric) of Concrete
ASTM C 143/C 143M	(2003) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C 150	(2002a _{el}) Standard Specification for Portland Cement
ASTM C 156	(1995) Water Retention by Concrete Curing Materials
ASTM C 171	(1997a) Standard Specification for Sheet Materials for Curing Concrete
ASTM C 172	(1999) Standard Practice for Sampling Freshly Mixed Concrete

ASTM C 192/C 192M	(2002) Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(2003) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2001) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C 309	(2003) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 31	(2000e1) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(2002) Standard Specification for Concrete Aggregates
ASTM C 39/C 39M	(2003) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C 494/C 494M	(1999ae1) Standard Specification for Chemical Admixtures for Concrete
ASTM C 618	(2003) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 94/C 94M	(2003a) Standard Specification for Ready-Mixed Concrete
ASTM D 1190	(1997) Standard Specification for Concrete Joint Sealer, Hot-Applied Elastic Type
ASTM D 1850	(1974; R 1979) Concrete Joint Sealer, Cold-Application Type
ASTM E 329	(1995; Rev A) Use in the Evaluation of Testing and Inspection Agencies as Used in Construction

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI DA4	(1998) Manual of Standard Practice
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NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST PS 1	(1995) Construction and Industrial Plywood
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U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS SS-S-200

(Rev E; Am 2) Sealants, Joint,
Two-Component, Jet-Blast-Resistant,
Cold-Applied, for Portland Cement Concrete
Pavement

1.2 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330,
"Submittal Procedures," in sufficient detail to show full compliance with
the specification:

SD-01 Preconstruction Submittals

Construction Equipment Lists shall be submitted by the Contractor
prior to construction in accordance with the paragraph entitled,
"General Information," of this section.

Records of Historical Data shall be submitted by the Contractor in
accordance with paragraph entitled, "General Information," of this
section.

SD-02 Shop Drawings

Fabrication Drawings for concrete formwork shall be submitted by
the Contractor in accordance with paragraph entitled, "Shop
Drawings," of this section, to include the following:

Reinforcement Materials
Wall Forms
Drilled Pier Dobies

Erection drawings for concrete Formwork shall show placement of
reinforcement and accessories, with reference to the contract
drawings.

SD-03 Product Data

Manufacturer's catalog data for the following items shall include
printed instructions for admixtures, bonding agents, epoxy-resin
adhesive binders, waterstops, and liquid chemical floor hardeners.

Concrete Aggregates
Portland Cement
Ready-Mix Concrete
Form Facing Materials

Reinforcement Materials
Joint Materials
Water-Vapor Barrier Subgrade Cover
Bonding Materials
Floor Finish Materials
Concrete Curing Materials

SD-05 Design Data

Mix design data for each class of Ready-Mix Concrete shall be submitted at least 15 calendar days prior to start of specified work.

SD-06 Test Reports

Reports for concrete shall be in accordance with the paragraph entitled, "Quality-Control Testing During Construction," of this section. Test reports of the chemical requirements of reinforcing bars shall also be submitted.

Chemical Composition
Mechanical Usability
Soundness
Slump
Air Entrainment
Compressive Strength

SD-07 Certificates

Certificates for concrete shall be in accordance with the paragraph entitled, "Classification and Quality of Concrete," of this section. Certificates shall contain project name and number, date, name of Contractor, name of concrete testing service, source of concrete aggregates, material manufacturer, brand name of manufactured materials, material name, values as specified for each material, and test results. Certificates for Welder Qualifications shall be in accordance with the paragraph entitled, "Qualifications for Welding Work," of this section.

Concrete Design Mixes
Concrete Aggregates
Welding Procedures

SD-08 Manufacturer's Instructions

Installation instructions shall indicate the manufacturer's recommended method and sequence of installation for the following items:

Admixtures
Bonding Materials
Liquid Chemical Floor Hardener

SD-11 Closeout Submittals

Records of Communication shall be submitted in accordance with paragraph entitled, "General Information," of this section.

SD-12 LEED Submittals

1. Credit MR 4.1 and 4.2: List of proposed materials with recycled content.
 - a. Indicate cost, post-consumer recycled content and post-industrial recycled content for each product having recycled content.
2. Credit MR 5.1 and 5.2: Submit invoices and documentation indicating manufacturing locations within 500 miles of the project site.
 - a. Include statements indicating cost for local/regional material (excluding labor, equipment and profit).
 - b. Include statements indicating location of extraction, harvest, or recovery of product components within 500 miles of the project.

1.4 QUALIFICATIONS FOR CONCRETE TESTING SERVICE

Concrete testing shall be performed by an approved laboratory and inspection service experienced in sampling and testing concrete. Testing agency shall meet the requirements of ASTM E 329.

1.5 CONCRETE SAMPLING AND TESTING

Testing by the Contractor shall include sampling and testing concrete materials proposed for use in the work and testing the design mix for each class of concrete. Quality control testing during construction shall be performed by the Contractor.

1.6 CONCRETE DESIGN MIXES

Mix proportions for each concrete class shall be determined and tested as follows:

<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Making and curing concrete specimens in the laboratory	ASTM C 192/C 192M	Two sets of three specimens for each design mix
Sampling fresh concrete in the laboratory	ASTM C 192/C 192M	One for each set of design mix specimens
Slump	ASTM C 143/C 143M	
Air content	ASTM C 231	
Yield	ASTM C 138/C 138M	
Compressive strength	ASTM C 39/C 39M	Three specimens

<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u> tested at 7 days, and three speci- mens tested at 28 days for each mix design
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Proportions of concrete mixtures shall be determined in accordance with ACI 304R and Method 1 of ACI 301, Section 3.8.2.1. Separate curves shall be prepared for air-entrained and nonair-entrained concretes. Provide mix designs according to the format provided at the back of this section.

1.7 DELIVERY AND STORAGE OF MATERIALS

Reinforcement and other metal items shall be protected from corrosion and shall be kept free from ice, grease, and other coatings that would destroy or reduce bond.

1.8 SHOP DRAWINGS

Fabrication Drawings for concrete formwork for Reinforcement Materials, Wall Forms and Floor Forms shall indicate concrete pressure calculations with both live and dead loads, along with material types. All design calculations shall be in accordance with ACI 304R and ACI 301, Chapter 4.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

2.1.1 Concrete Aggregates

Fine and coarse aggregates shall conform to ASTM C 33.

Concrete aggregate for architectural concrete shall be obtained from a single source.

2.1.2 Portland Cement

Cement shall conform to ASTM C 150, Type V. One brand and type of cement shall be used for formed concrete having exposed-to-view finished surfaces.

2.1.3 Admixtures

2.1.3.1 Air-Entraining Admixtures

Air-entraining admixtures shall conform to ASTM C 260.

2.1.3.2 Water-Reducing Admixtures

Water-reducing admixtures, retarding admixtures, accelerating admixtures, water-reducing and accelerating admixtures, and water-reducing and retarding admixtures shall conform to ASTM C 494/C 494M.

2.1.3.3 Pozzolan

Fly ash is required to be used as the admixtures it shall conform to ASTM C 618, Class C or Class F with 4 percent maximum loss on ignition and 20 percent maximum cement replacement by weight.

2.1.4 Water

Water shall be potable.

2.2 READY-MIX CONCRETE

Concrete shall meet the requirements of ASTM C 94/C 94M.

Ready-mixed concrete manufacturer shall provide duplicate delivery tickets with each load of concrete delivered. Delivery tickets shall provide the following information in addition to that required by ASTM C 94/C 94M:

Type and brand cement

Cement content in 94-pound bags per cubic yard of concrete

Maximum size of aggregate

Amount and brand name of admixtures

Total water content expressed by water/cement ratio

Time of batch

Time that truck left the batch plant

Time indicating when concrete has completed discharging

2.3 FORM FACING MATERIALS

2.3.1 Concrete Form Plywood (Standard Rough)

Plywood shall conform to NIST PS 1, B-B, concrete form, not less than 5/8-inch thick.

2.4 REINFORCEMENT MATERIALS

2.4.1 Reinforcing Bars

Reinforcing bars shall conform to ASTM A 615/A 615M and Supplemental S1, Grade 60.

2.4.2 Dowels for Load Transfer in Floors

Dowels for load transfer in floors shall be of the type, design, weight, and dimensions indicated. Dowel bars shall be plain-billet steel conforming to ASTM A 615/A 615M, Grade 40. Dowel pipe shall be steel conforming to ASTM A 53.

2.4.3 Supports for Reinforcement

Supports shall include bolsters, chairs, spacers, and other devices necessary for proper spacing, supporting, and fastening reinforcing bars in place.

Supports shall be wire bar type conforming to ACI 315 and CRSI DA4.

Legs of supports in contact with formwork shall be hot-dip galvanized, or plastic coated after fabrication, or stainless-steel bar supports.

2.5 JOINT MATERIALS

2.5.1 Joint Sealant Compound

Compound shall be cold-applied, mastic, single- or multiple-component type conforming to ASTM D 1850.

Compound shall be hot-poured, elastic type conforming to ASTM D 1190.

Compound shall be cold-applied, two-component, elastomeric polymer type conforming to FS SS-S-200.

2.6 WATER-VAPOR BARRIER SUBGRADE COVER

Water-Vapor Barrier: Nylon or polyester cord reinforced, high-density polyethylene sheet conforming to ASTM E 1745, Class B except that water vapor permeance limit is 0.060 perms.

Available Product: Subject to compliance with requirements, a product that may be incorporated into the work includes, but is not limited to, "Griffolyn Type 85" by Reef Industries, Inc.

2.7 FLOOR FINISH MATERIALS

2.7.1 Liquid Chemical Floor Hardener

Hardener shall be a colorless aqueous solution containing a blend of magnesium fluorosilicate and zinc fluorosilicate combined with a wetting agent. Solution shall contain not less than 2 pounds of fluorosilicates per gallon. An approved proprietary chemical hardener may be used provided hardener is delivered ready for use in manufacturer's original containers.

2.8 CONCRETE CURING MATERIALS

2.8.1 Absorptive Cover

Cover for curing concrete shall be burlap cloth made from jute or kenaf, weighing 9 ounces plus or minus 5 percent per square yard when clean and dry, conforming to ASTM C 171, Class 3; or cover may be cotton mats as approved.

2.8.2 Moisture-Retaining Cover

Cover for curing concrete shall be waterproof paper conforming to ASTM C 171, regular or white, or polyethylene sheeting conforming to ASTM C 171, or polyethylene-coated burlap consisting of a laminate of burlap and a white opaque polyethylene film permanently bonded to the burlap; burlap shall conform to ASTM C 171, Class 3, and polyethylene film shall conform to ASTM C 171. When tested for water retention in accordance with ASTM C 156, weight of water lost 72 hours after application of moisture retaining covering material shall not exceed 0.039 gram per square centimeter of the mortar specimen surface.

2.8.3 Water

Water shall be potable.

2.8.4 Membrane-Forming Curing Compound

Compound shall be liquid type conforming to ASTM C 309, Type 1, clear, Type 1D with fugitive dye for interior work and Type 2, white, pigmented for exterior work.

2.9 CLASSIFICATION AND QUALITY OF CONCRETE

2.9.1 Concrete Classes and Usage

Concrete classes, compressive strength, requirements for air entrainment, and usage shall be as follows:

<u>CONCRETE CLASS</u>	<u>MIN. 28-DAY COMPRESSIVE STRENGTH POUNDS PER SQ. IN.</u>	<u>REQUIREMENT FOR AIR ENTRAINMENT</u>	<u>USAGE</u>
B	3,000	None	For interior slab-on-grade
A	4,000	Air-entrained	Use unless otherwise noted
C	4,500	None	Drilled caissons

2.9.2 Limits for Concrete Proportions

Limits for maximum water/cement ratio and minimum cement content for each concrete class shall be as follows:

<u>CONCRETE CLASS</u>	<u>MAX. WATER/CEMENT RATIO BY WEIGHT</u>	<u>MIN. CEMENT FOR 3- TO 4-INCH SLUMP, (NO. OF 94- POUND SACKS) PER CU. YD.</u>
B	0.50	5.25
A	0.45	6.0

<u>CONCRETE CLASS</u>	<u>MAX. WATER/CEMENT RATIO BY WEIGHT</u>	<u>MIN. CEMENT FOR 3- TO 4-INCH SLUMP, (NO. OF 94- POUND SACKS) PER CU. YD.</u>
C	0.45	6.25

* Weight of water to weight of cementitious materials in pounds in one cubic yard of concrete

2.9.3 Maximum Size of Aggregate

Size of aggregate, designated by the sieve size on which maximum amount of retained coarse aggregate is 5 to 10 percent by weight, shall be as follows:

<u>MAXIMUM SIZE OF AGGREGATE</u>	<u>ASTM C 33 SIZE NUMBER</u>	<u>TYPE OF CONSTRUCTION</u>
2 inches	357	Nonreinforced footings and other flat work having a depth of not less than 6 inches, and nonreinforced walls and other formed sections having a dimension between forms of not less than 10 inches
1-1/2 inches	467	Monolithic slabs on ground, concrete fill, and other flatwork having a depth of not less than 5 inches and a clear distance between reinforcing bars of not less than 2 inches, drilled piers
3/4 inch	67	Reinforced walls, columns, girders, beams, and other formed sections having a dimension between forms of not less than 6 inches and clear distance between reinforcing bars or reinforcing bar and face of form of not less than 1 inch
3/4 inch	67	Monolithic concrete slabs and other flatwork having a depth of not less than 2-1/2 inches and a clear distance between reinforcing bars of not less than 1 inch
1/2 inch	7	Concrete joist construction, beams, reinforced walls, and

<u>MAXIMUM SIZE OF AGGREGATE</u>	<u>ASTM C 33 SIZE NUMBER</u>	<u>TYPE OF CONSTRUCTION</u>
		other formed work having a clear distance between reinforcing bars and face of form of less than 1 inch
3/8 inch	8	Nonreinforced slabs and other flatwork having a depth of less than 2-1/2 inches

Maximum size of aggregate may be that required for most critical type of construction using that concrete class.

Gradation of aggregates shall be as specified for separate floor topping.

2.9.4 Slump

Slump for concrete at time and in location of placement shall be as follows:

<u>TYPE OF CONSTRUCTION</u>	<u>SLUMP</u>
Footings, unreinforced walls and slabs-on-grade	3 inches; tolerance minus 1 inch plus 1 inch (maximum slump when using plasticizer: 6 inches after admixture is added to concrete with 3 inch slump).
Drilled piers, grade beams	5 inches; tolerance minus 1 inch plus 1 inch (maximum slump when using plasticizer: 6 inches after admixture is added to concrete with 3 inch slump)

2.9.5 Total Air Content

Air content of exposed concrete and interior concrete shall be in accordance with ASTM C 260 and/or as follows:

<u>LIMITS CONCRETE EXPOSURE</u>	<u>REQUIREMENT FOR AIR ENTRAINMENT</u>	<u>TOTAL AIR CONTENT BY VOLUME</u>
All elements except interior slabs	Non Air-entrained	6 percent
Interior Slabs	Non Air-entrained	3 percent

Concrete exposed to freezing and thawing or subjected to hydraulic pressure shall be air-entrained by addition of approved air-entraining admixture to

concrete mix.

PART 3 EXECUTION

3.1 FORMWORK

3.1.1 General

Forms shall be constructed to conform, within the tolerances specified, to shapes, dimensions, lines, elevations, and positions of cast-in-place concrete members as indicated. Forms shall be supported, braced, and maintained sufficiently rigid to prevent deformation under load.

3.1.2 Design and Construction of Form work

Form work design and construction shall conform to ACI 304R and ACI 301, Chapter 4.

Forms shall be tight to prevent leakage of cement paste during concrete placing.

Form facing materials shall be supported by structural members spaced close to prevent deflection of form facing material. Forms placed in successive units for continuous surfaces shall be fitted to accurate alignment to ensure a smooth completed surface within the tolerances specified. Where necessary to maintain the tolerances specified, such as long spans where immediate supports are not possible, formwork shall be cambered for anticipated deflections in formwork due to weight and pressure of fresh concrete and to construction loads.

Exposed joints, edges, and external corners shall be chamfered a minimum of 3/4 inch by moldings placed in corners of column, beam, and wall forms.

Forms shall be readily removable without impact, shock, or damage to concrete.

3.1.3 Forms for Standard Rough Form Finish

Rough form finish shall be given concrete formed surfaces that are to be concealed by other construction, unless otherwise specified.

Form facing material for standard rough form finish shall be the specified concrete form plywood or other approved form facing material that will produce concrete surfaces equivalent in smoothness and appearance to that produced by new concrete form plywood panels.

For concrete surfaces exposed only to the ground, undressed, square-edge, 1-inch nominal thickness lumber may be used. Horizontal joints shall be level and vertical joints shall be plumb.

3.1.4 Form Ties

Ties shall be factory fabricated metal, adjustable in length, removable or snap-off type that will not allow form deflection or will not spall

concrete upon removal. Portion of form ties remaining within concrete after removal of exterior parts shall be at least 1-1/2 inches back from concrete surface. Form ties shall be free of devices that will leave a hole larger than 7/8 inch or less than 1/2 inch in diameter in concrete surface. Form ties fabricated at the project site or wire ties of any type are not acceptable.

3.1.5 Tolerances for Form Construction

Formwork shall be constructed to ensure that after removal of forms and prior to patching and finishing of formed surfaces, concrete surfaces shall be in accordance with tolerances specified in ACI 117 and ACI 304R.

3.1.6 Preparation of Form Surfaces

Contact surfaces of forms shall be coated with form-coating compound before reinforcement is placed. Form-coating compound shall be a commercial formulation that will not bond with, stain, nor adversely affect concrete surfaces and will not impair subsequent treatment of concrete surfaces that entails bonding or adhesion nor impede wetting of surfaces to be cured with water or curing compounds. Excess form-coating compound shall not be allowed to stand in puddles in the forms nor to come in contact with concrete against which fresh concrete will be placed. Thinning of form-coating compound shall be made with thinning agent of the type, in the amount, and under the conditions recommended by form-coating compound manufacturer's printed or written directions.

3.1.7 Removal of Forms

Formwork that does not support weight of concrete, such as sides of beams, walls, columns, and similar vertical parts of the work, may be removed 24 hours after placing concrete, provided concrete is sufficiently hard not to be damaged from form-removal operations.

Formwork that supports weight of concrete, such as beam soffits, slabs, and similar horizontal parts of the work, shall remain in place at least until concrete has attained design minimum laboratory compressive strength at 28 days for applicable concrete class specified.

Form facing material may be removed before concrete has attained its required 28-day compressive strength but in no case less than 6 days after placing concrete, provided shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports. Shores and other vertical supports shall remain in place until concrete has attained its required 28-day compressive strength.

Results of control tests will be used as evidence that concrete has attained sufficient strength to permit removal of supporting forms. Test specimens shall be removed from molds at the end of 24 hours and stored in the structure as near points of sampling as possible; shall receive same protection from elements during curing as is given those portions of the structure which they represent; and shall not be removed from the structure for transmittal to the laboratory prior to expiration of three-fourths of

proposed period before removal of forms. Supporting forms of shoring shall not be removed until strength of control-test specimens has attained a value of at least 2,000 psi. Contractor shall ensure that newly unsupported portions of the structure are not subjected to heavy construction or material loading.

Tie-rod clamps to be removed from wall shall be loosened 24 hours after concrete is placed; form ties, except for a sufficient number to hold forms in place, may be removed at that time. Ties wholly withdrawn from wall shall be pulled toward inside face.

When formwork is removed during concrete curing period, exposed concrete shall be cured as specified.

3.1.8 Re-Use of Forms

Surfaces or forms that are to be re-used shall be cleaned and repaired, except that split, frayed, or delaminated form facing material shall not be re-used. Contact surfaces of re-used forms shall be coated as specified.

3.2 REINFORCEMENT FABRICATION AND INSTALLATION

3.2.1 General

Details of reinforcement shall be in accordance with ACI 315 and ACI 318/318R, and as specified.

3.2.2 Fabrication

Reinforcing bars shall be shop fabricated to conform to shapes and dimensions indicated for reinforcement, and as follows:

Fabrication tolerances shall be in accordance with ACI 304R, ACI 315, and ACI 117.

Hooks and bends shall be in accordance with ACI 315 and ACI 318/318R.

Reinforcement shall be bent cold to shapes as indicated. Bending shall be done in the shop. Rebending of a reinforcing bar that has been bent incorrectly shall not be permitted. Bending shall be in accordance with standard approved practice and by approved machine methods.

Tolerance on nominally square-cut, reinforcing bar ends shall be in accordance with ACI 315.

Reinforcing bars shall be delivered bundled, tagged, and marked. Tags shall be metal with bar size, length, mark, and other information pressed in by machine. Marks shall correspond with those used on the placing drawings.

Reinforcement which has any of the following defects shall not be used:

Bar lengths, depths, and bends beyond specified fabrication tolerances

Bends or kinks not indicated on drawings or approved shop drawings

Bars with reduced cross-section due to rusting or other cause

Defective reinforcement shall be replaced with new reinforcement having required shape, form, and cross-section area.

3.2.3 Placing Reinforcement

Reinforcement shall be placed in accordance with ACI 315 and ACI 318/318R.

For slabs on grade (over earth or over capillary water barrier) and for footing reinforcement, bars or welded wire fabric shall be supported on precast concrete blocks, spaced at intervals required by size of reinforcement, to keep reinforcement the minimum height specified above the underside of slab or footing.

Contractor shall cooperate with other trades in setting of anchor bolts, inserts, and other embedded items. Where conflicts occur between locating reinforcing and embedded items, the Contractor shall notify the Contracting Officer so that conflicts may be reconciled before placing concrete. Anchors and embedded items shall be positioned and supported with appropriate accessories.

Reinforcement shall be supported and secured together to prevent displacement by construction loads or by placing of wet concrete, and as follows:

Supports for reinforcing bars shall be sufficient in number and sufficiently heavy to carry the reinforcement they support, and in accordance with ACI 315 and CRSI DA4. Supports shall not be used to support runways for concrete conveying equipment and similar construction loads.

Supports on ground and similar surfaces shall be equipped with sand-plates.

Reinforcements shall be secured to supports by means of tie wire. Wire shall be black, soft iron wire, not less than 16 gage.

Reinforcement shall be accurately placed, securely tied at intersections with 18-gage annealed wire, and held in position during placing of concrete by spacers, chairs, or other approved supports. Wire-tie ends shall point away from the form. Unless otherwise indicated, numbers, type, and spacing of supports shall conform to ACI 315.

Bending of reinforcing bars partially embedded in concrete will be permitted only as specified in ACI 315 and ACI 318/318R.

3.2.4 Spacing of Reinforcing Bars

Spacing shall be as indicated. If not indicated, spacing shall be in accordance with the ACI 315 and ACI 318/318R.

Reinforcing bars may be relocated to avoid interference with other reinforcement, or with conduit, pipe, or other embedded items. If any reinforcing bar is moved a distance exceeding one bar diameter or specified placing tolerance, resulting rearrangement of reinforcement shall be subject to approval.

3.2.5 Splices in Reinforcement

Splices shall be as indicated on the approved drawings.

3.2.6 Concrete Protection for Reinforcement

Concrete protection shall be in accordance with the ACI 315 and ACI 318/318R.

3.3 JOINTS

3.3.1 Construction Joints

Joints not indicated shall be made and located so as not to impair strength and appearance of the structure and shall be as approved. Construction joints shall be located as follows:

In walls at not more than 60 feet in any horizontal direction; at top of footing; at top of slabs on ground; at top and bottom of door and window openings or where required to conform to architectural details; and at underside of deepest beam or girder framing into wall

In slabs on ground, so as to divide slab into areas not in excess of 1,200 square feet

Joints shall be perpendicular to main reinforcement. Reinforcement shall be continued across construction joints.

3.3.2 Control Joints in Slabs on Ground

Joints shall be provided to form panels as indicated.

Under and on exact line of each control joint, 50 percent of welded wire fabric reinforcement shall be cut before placing concrete.

Joints shall be 1/8-inch wide by 1/5 to 1/4 of slab depth and shall be formed by inserting hand-pressed fiberboard strip into fresh concrete until top surface of strip is flush with slab surface or by cutting the concrete with a saw after the concrete has set. After concrete has cured for at least 7 days, the Contractor shall remove inserts and clean groove of foreign matter and loose particles.

3.3.3 Sealing Joints in Slabs on Ground

Isolation and control joints which will not be covered with finish flooring material shall be sealed with joint sealing compound after concrete curing period. Groove shall be slightly underfilled with joint sealing compound to prevent extrusion of compound. Excess material shall be removed as soon

after sealing as possible.

Sealing shall not be required for isolation and control joints which will be covered with finish flooring material. Groove shall be left ready to receive filling material that will be provided as part of finish floor covering work.

3.4 INSTALLATION OF ANCHORAGE DEVICES

3.4.1 General

Anchorage devices and embedded items required for other work that is attached to, or supported by, cast-in-place concrete shall be set and built in as part of the work of this section, using setting drawings, instructions, and directions for work to be attached thereto.

3.4.2 Placing Anchorage Devices

Anchorage devices and embedded items shall be positioned accurately and supported against displacement. Openings in anchorage devices such as slots and threaded holes shall be filled with an approved, removable material to prevent entry of concrete into openings.

3.5 PREPARATIONS FOR CONCRETE PLACING

3.5.1 General

Surfaces against which concrete is to be placed shall be free of debris, loose material, standing water, snow, ice, and other deleterious substances before start of concrete placing.

Standing water shall be removed without washing over freshly deposited concrete. Flow of water shall be diverted through side drains provided for such purpose.

3.5.2 Subgrade Under Foundations and Footings

When subgrade material is semiporous and dry, subgrade surface shall be sprinkled with water as required to eliminate suction at the time concrete is deposited. When subgrade material is porous, subgrade surface shall be sealed by covering surface with specified water barrier subgrade cover; this may also be used over semiporous, dry subgrade material instead of water sprinkling.

See General Notes Section D2.

3.5.3 Subgrade Under Slabs on Ground

Before construction of slabs on ground, underground work on pipes and conduits shall have been completed and approved.

Previously constructed subgrade or fill shall be cleaned of foreign materials and shall be inspected by the Contractor for adequate compaction and surface tolerances as specified.

<u>SOIL MATERIAL</u>	<u>PERCENT MAXIMUM DENSITY</u>
Drainage fill	98
Cohesionless soil material	98
Cohesive soil material	98

Finish surface of drainage course under interior slabs on ground shall be a graded mixture of crushed gravel, crushed stone, and/or crushed sand ASTM D 2940 with 100 percent passing the 3/4 inch sieve, 30-60 percent passing the No. 4 sieve and less than 5 percent passing the No. 200 sieve.

Finished surface of subgrade or fill under exterior slabs on ground shall be not more than 0.02-foot above or 0.10-foot below elevation indicated.

Drainage course under interior slabs on ground shall be covered with specified water-vapor barrier subgrade cover immediately prior to placing reinforcement. Subgrade cover shall be installed to avoid puncture or tear. Punctures or tears over 12 inches shall be patched with separate sheets lapped not less than 6 inches. All punctures or tears less than 12 inches shall be sealed with pressure-sensitive vapor barrier tape not less than 2-inches wide. Lapped joints shall be sealed with vapor barrier adhesive or pressure-sensitive vapor barrier tape not less than 2-inches wide. Subgrade cover sheets shall be laid with not less than a 6-inch lap at edges and ends and in direction in which concrete is to be placed.

Subgrade or fill surface under exterior slabs on ground shall be prepared as specified for subgrade under foundations and footings.

3.5.4 Formwork

Formwork shall be complete and approved. Debris and foreign material shall be removed from interior of forms before start of concrete placing.

3.5.5 Edge Forms and Screed Strips for Slabs

Edge forms or bulkheads and intermediate screed strips for slabs shall be set to obtain indicated elevations and contours in finished slab surface and shall be strong to support vibrating bridge screeds or roller pipe screeds if nature of specified slab finish requires use of such equipment. Concrete surface shall be aligned to elevation of screed strips by use of strike-off templates or approved compacting-type screeds.

3.5.6 Reinforcement and Other Embedded Items

Reinforcement, joint materials, and other embedded materials shall be secured in position, inspected, and approved before start of concrete placing.

3.6 CONCRETE CONVEYING

3.6.1 Transfer of Concrete At Project Site

Concrete shall be handled from point of delivery and transfer to concrete conveying equipment and to locations of final deposit as rapidly as practical by methods which will prevent segregation and loss of concrete mix materials.

3.6.2 Mechanical Equipment for Conveying Concrete

Equipment shall ensure a continuous flow of concrete at delivery end and shall be as approved. Runways for wheeled concrete-conveying equipment shall be provided from concrete delivery point to locations of final deposit. Interior surfaces of concrete conveying equipment shall be free of hardened concrete, debris, water, snow, ice, and other deleterious substances.

3.7 CONCRETE PLACING

3.7.1 Weather Limitations and Protection

Concrete shall not be placed when the temperature of the atmosphere is below 40 degrees F, nor during rain, sleet, or snow, unless protection is provided.

Protection shall be provided during cold weather in accordance with ACI 304R and ACI 301.

During inclement weather, protection material shall be watertight to prevent entry of rain, sleet, or snow onto surfaces to receive concrete and into fresh concrete.

Protection materials shall be stored at project site for use in event of unforeseen weather changes after start of concrete placing operations.

3.7.2 General Placing Requirements

Concrete shall be deposited continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section. If a section cannot be placed continuously, construction joints shall be provided as specified. Concrete placing shall be performed at such a rate that concrete which is being integrated with fresh concrete is still plastic. Concrete shall be deposited as nearly as practical in its final position to avoid segregation due to rehandling or flowing. Concrete shall not be subjected to procedures which will cause segregation.

Concrete to receive other construction shall be screeded to proper level to avoid excessive skimming or grouting.

Concrete which becomes nonplastic and unworkable or does not meet quality control limits as specified or has been contaminated by foreign materials shall not be used. Use of retempered concrete will not be permitted. Rejected concrete shall be removed from the site.

3.7.3 Placing Concrete in Forms

Concrete placed in forms shall be deposited in horizontal layers not exceeding 24 inches.

Temporary spreaders in forms shall be removed when concrete placing has reached elevation of spreaders.

Concrete placed in forms shall be consolidated by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Vibrators shall be designed to operate with vibratory element submerged in concrete and shall maintain a speed of not less than 9,000 impulses per minute when submerged in concrete. Vibrating equipment shall be adequate in number of units and power of each unit to properly consolidate concrete. Vibration of forms and reinforcement shall not be permitted. Vibrators shall not be used to transport concrete inside forms. Vibrators shall be inserted and withdrawn vertically at uniformly spaced points not farther apart than visible effectiveness of machine. Vibrator shall not be inserted into lower courses of concrete that have begun to set. At each insertion, duration of vibration shall be limited to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of concrete mix.

Placing of concrete in supporting elements shall not be started until concrete previously placed in columns and walls is no longer plastic and has been in place a minimum of 2 hours.

3.7.4 Placing Concrete Slabs

Concrete for slabs shall be placed and consolidated in a continuous operation, within the limits of approved construction joints until placing of panel or section is completed.

During concrete placing operations, concrete shall be consolidated by mechanical vibrating equipment so that concrete is worked around reinforcement and other embedded items and into corners. Concrete placed in beams and girders of supported slabs and against bulkheads of slabs on ground shall be consolidated by mechanical vibrators as specified. Concrete in remainder of slabs shall be consolidated by vibrating bridge screeds, roller pipe screeds, or other approved method. Consolidation operations shall be limited to time necessary to obtain consolidation of concrete without bringing an excess of fine aggregate to the surface. Concrete to be consolidated shall be as dry as practical and surfaces thereof shall not be manipulated prior to finishing operations. Concrete shall be brought to correct level with a straightedge and struck-off. Bull floats or darbies shall be used to smooth surface, leaving it free of humps or hollows. Sprinkling of water on plastic surface shall not be permitted.

Finish of slabs shall be as specified.

3.7.5 Bonding

Surfaces of set concrete at joints, except where bonding is obtained by use of concrete bonding agent, shall be roughened and cleaned of laitance,

coatings, loose particles, and foreign matter. Surfaces shall be roughened in a manner that will expose the aggregate uniformly and will not leave laitance, loosened particles of aggregate, nor damaged concrete at the surface.

Bonding of fresh concrete that has set shall be obtained as follows:

At joints between footings and walls or columns, between walls or columns and the beams or slabs they support, and elsewhere unless otherwise specified; roughened and cleaned surface of set concrete shall be dampened, but not saturated, immediately prior to placing of fresh concrete.

At joints in exposed-to-view work; at vertical joints in walls; at joints near midpoint of span in girders, beams, supported slabs, and other structural members; and at joints in work designed to contain liquids; the roughened and cleaned surface of set concrete shall be dampened but not saturated and covered with a cement grout coating.

Cement grout shall consist of equal parts of portland cement and fine aggregate by weight with not more than 6 gallons of water per sack of cement. Cement grout shall be applied with a stiff broom or brush to a minimum thickness of 1/16 inch. Fresh concrete shall be deposited before cement grout has attained its initial set.

Bonding of fresh concrete to concrete that has set may be obtained by use of a concrete bonding agent. Such bonding material shall be applied to cleaned concrete surface in accordance with approved printed instructions of bonding material manufacturer.

3.8 FINISHING OF FORMED SURFACES

3.8.1 Repairing and Patching Defective Areas

Immediately after removal of forms, defective areas shall be repaired and patched with cement mortar.

Honeycomb, rock pockets, voids over 1/2 inch in diameter, and holes left by tie rods and bolts shall be cut out to solid concrete, but in no case to a depth of less than 1 inch. Edges of cuts shall be perpendicular to surface of concrete. Before placing cement mortar, area to be patched at least 6 inches adjacent thereto shall be cleaned, dampened with water, and brush coated with neat portland cement grout. Cement mortar for patching shall consist of one part standard portland cement to two parts fine aggregate passing No. 16 mesh sieve and as little water as necessary for handling and placing. Where concrete surface will be exposed to view, portland cement portion of cement mortar shall be a blend of white and standard portland cement so that when dry, cement mortar will match surrounding concrete in color. Cement mortar shall be compacted in place and struck off slightly higher than the surrounding surface. Holes extending through concrete shall be filled by means of a plunger type gun or other suitable device from unexposed face, using a stop held at exposed face to ensure complete filling.

3.8.2 Standard Rough Form Finish

Finish shall be the concrete surface having texture imparted by form facing material used, defective areas repaired and patched as specified, and fins and other projections exceeding 1/4 inch in height rubbed down with wood blocks.

3.8.3 Related Unformed Surfaces

Tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces shall be struck off smooth after concrete is placed and shall be finished to a texture matching that of adjacent formed surfaces. Final surface treatment on formed surfaces shall continue uniformly across adjacent unformed surfaces.

3.8.4 Formwork

Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 or as indicated.

Lateral alignment tolerance for grade beams or foundation walls: Plus 1/4-inch, minus 1/4-inch.

Level alignment/elevation at top of grade beams or foundation walls: Plus 1/4-inch, minus 3/8-inch.

Level alignment/flatness at top of grade beams or foundation walls: 1/4-inch/10 foot straightedge.

Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

Class B, 1/4-inch (6 mm): Grade beams and walls.

Class D, 1 inch (25 mm): Caps and footings.

3.9 FINISHING OF SLABS

3.9.1 Float Finish

A float finish shall be given to slab surfaces that are to receive trowel finish and other finishes as specified and to slab surfaces that are to be covered with membrane waterproofing, membrane roofing, or terrazzo.

After placing is completed, concrete shall not be worked further until ready for floating. Floating shall begin when water has disappeared, or when concrete mix has stiffened sufficiently to permit proper operation of a power-driven float, or when both conditions have occurred. Any surface water remaining shall be removed before floating. Surface shall then be consolidated with power-driven floats. Hand floating shall be used in locations inaccessible to power-driven floats. Trueness of surface shall be checked at this stage with a 10-foot straightedge. Surface shall be plane to a tolerance not exceeding 1/4 inch in 10 feet when tested with a 10-foot straightedge placed on the surface at not less than two different angles. High spots shall be cut down and low spots shall be filled. Surfaces shall be uniformly sloped to drains. Immediately after completion

of leveling, surface shall be refloated to a uniform, smooth, granular texture.

3.9.2 Trowel Finish

Finish shall be given to slab surfaces that are to be exposed to view, and to slab surfaces to be covered with resilient flooring, paint, or other finish coating system.

After completion of float finish as specified above, the surface shall receive a trowel finish. First troweling after completion of float finish shall be done by a power-driven trowel and shall produce a smooth surface which is free of defects but which may contain some trowel marks.

Additional trowelings shall be done by hand after surface has hardened sufficiently. Final troweling shall be started when a ringing sound is produced as trowel is moved over surface. Surface shall be consolidated by hand troweling operation. Finished surface shall be free of trowel marks, uniform in texture and appearance, and plane to a tolerance not exceeding 1/4 inch in 10 feet when tested with a 10-foot straightedge placed on the surface in any direction. Surface defects of sufficient magnitude to show through floor covering shall be removed by grinding.

3.9.3 Chemical-Hardener Treatment

Liquid-chemical floor hardener shall be applied where indicated after curing and drying concrete surface. Liquid hardener shall be diluted with water and applied in three coats. First coat shall be one-third strength, second coat one-half strength, and third coat two-thirds strength. Each coat shall be applied evenly and allowed to dry 24 hours between coats.

Approved proprietary chemical hardeners shall be applied in accordance with manufacturer's printed directions.

3.10 CONCRETE CURING AND PROTECTION

3.10.1 General

Freshly placed concrete shall be protected from premature drying and cold or hot temperature and shall be maintained without drying at a relatively constant temperature for the period of time necessary for hydration of cement and proper hardening of concrete.

Initial curing shall start as soon as free water has disappeared from surface of concrete after placing and finishing. Concrete shall be kept moist for minimum 72 hours.

Final curing shall immediately follow initial curing and before concrete has dried. Final curing shall continue until cumulative number of hours or fraction thereof (not necessarily consecutive) during which temperature of air in contact with the concrete is above 50 degrees F has totaled 168 hours. Alternatively, if tests are made of cylinders kept adjacent to the structure and cured by the same methods, final curing may be terminated when the average compressive strength has reached 70 percent of the 28-day

design compressive strength. Rapid drying at end of final curing period shall be prevented.

3.10.2 Curing Methods

Curing shall be accomplished by moist curing, by moisture-retaining cover curing, by membrane curing, and by combinations thereof, as specified.

Moist curing:

Moisture curing shall be accomplished by any of the following methods:

Keeping surface of concrete wet by covering with water

Continuous water spraying

Covering concrete surface with specified absorptive cover for curing concrete saturated with water and keeping absorptive cover wet by water spraying or intermittent hosing. Absorptive cover shall be placed to provide coverage of concrete surfaces and edges with a slight overlap over adjacent absorptive covers.

Moisture-cover curing:

Moisture-retaining cover curing shall be accomplished by covering concrete surfaces with specified moisture-retaining cover for curing concrete. Cover shall be placed directly on concrete in widest practical width, with sides and ends lapped at least 3 inches. Cover shall be weighted to prevent displacement; tears or holes appearing during curing period shall be immediately repaired by patching with pressure-sensitive, waterproof tape or other approved method.

Membrane curing:

Membrane curing shall be accomplished by applying specified membrane-forming curing compound to damp concrete surfaces as soon as moisture film has disappeared. Curing compound shall be applied uniformly in a two-coat operation by power-spraying equipment using a spray nozzle equipped with a wind guard. Second coat shall be applied in a direction at right angles to direction of first coat. Total coverage for two coats shall be not more than 200 square feet per gallon of curing compound. Concrete surfaces which are subjected to heavy rainfall within 3 hours after curing compound has been applied shall be resprayed by method and at rate specified. Continuity of coating shall be maintained for entire curing period and damage to coating during this period shall be repaired immediately.

Membrane-curing compounds shall not be used on surfaces that are to be covered with coating material applied directly to concrete or with a covering material bonded to concrete, such as other concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, painting, and other coatings and finish materials.

3.10.3 Curing Formed Surfaces

Curing of formed surfaces, including undersurfaces of girders, beams, supported slabs, and other similar surfaces shall be accomplished by moist curing with forms in place for full curing period or until forms are removed. If forms are removed before end of curing period, final curing of formed surfaces shall be accomplished by any of the curing methods specified above, as applicable.

3.10.4 Curing Unformed Surfaces

Initial curing of unformed surfaces, such as monolithic slabs, floor topping, and other flat surfaces, shall be accomplished by membrane curing.

Unless otherwise specified, final curing of unformed surfaces shall be accomplished by any of curing methods specified above, as applicable.

Final curing of concrete surfaces to receive liquid floor hardener of finish flooring shall be accomplished by moisture-retaining cover curing.

3.10.5 Temperature of Concrete During Curing

When temperature of atmosphere is 40 degrees F and below, temperature of concrete shall be maintained at not less than 55 degrees F throughout concrete curing period or 45 degrees F when the curing period is measured by maturity. When necessary, arrangements shall be made before start of concrete placing for heating, covering, insulation, or housing as required to maintain specified temperature and moisture conditions for concrete during curing period.

When the temperature of atmosphere is 80 degrees F and above or during other climatic conditions which will cause too rapid drying of concrete, arrangements shall be made before start of concrete placing for installation of wind breaks, of shading, and for fog spraying, wet sprinkling, or moisture-retaining covering of light color as required to protect concrete during curing period.

Changes in temperature of concrete shall be uniform and shall not exceed 5 degrees F in any 1 hour nor 50 degrees F in any 24-hour period.

3.10.6 Protection from Mechanical Injury

During curing period, concrete shall be protected from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration and from damage caused by rain or running water.

3.10.7 Protection After Curing

Finished concrete surfaces shall be protected from damage by construction operations.

3.11 QUALITY-CONTROL TESTING DURING CONSTRUCTION

Concrete shall be sampled and tested for quality control by the testing agency during the placement of the concrete as follows:

<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Sampling fresh concrete	ASTM C 172 except modified for slump per ASTM C 94/C 94M	As required for each test
Slump test	ASTM C 143/C 143M	One for each concrete load at point of discharge and one for each set of compressive strength tests
Air content by pressure method	ASTM C 231	One for each set of compressive strength tests
Compression test specimens	ASTM C 31	One set of six standard cylinders for each compressive strength test
Concrete temperature		Hourly when air temperature is 40 degrees F or below and 80 degrees F or above; each time a set of compression test specimens is made
Compressive strength test	ASTM C 39/C 39M	One set for each 150 cubic yards or fraction thereof of each concrete class placed in any one day; two specimens tested at 7 days, three specimens tested at 28 days and one specimen retained in reserve for testing if required

Test reports for concrete for Chemical Composition, Mechanical Usability and Soundness shall be submitted by the Contractor meeting all design specifications as required by referenced standards within this section.

3.11.1 Concrete Testing Technician

The concrete testing Technician must immediately inform the Contractor's

Project Superintendent of batch test results.

Concrete incorporated in the Work that does not comply with all specified fresh concrete properties is subject to rejection and replacement at the Contractor's expense.

3.11.2 Test Results

Test Results shall be reported in writing to Engineer, Concrete Manufacturer, and Contractor within 48 hours of testing. Reports of tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work by grid designation and elevation, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for 28 day tests.

3.12 INSPECTION AND ACCEPTANCE PROVISIONS

3.12.1 Evaluation of Compressive Strength Tests

Concrete quality control test will be evaluated as specified.

Compressive strength tests will be considered satisfactory if the average of all sets of five consecutive compressive strength tests equal or exceed the 28-day design compressive strength, or if no individual compressive strength test (average of two cylinders) falls below the required 28-day design compressive strength by more than 500 pounds per square inch.

If compressive strength tests fail to meet minimum requirements specified, concrete represented by such tests will be considered deficient in strength and subject to provisions specified.

3.12.2 Strength of Concrete Structure

Strength of concrete structure in place will be considered deficient if it fails to comply with requirements which control strength of structure, including following conditions:

Failure to meet compressive strength tests as evaluated

Reinforcement not conforming to requirements specified

Concrete which differs from required dimensions or location in such a manner as to reduce strength

Concrete curing and protection of concrete against extremes of temperature during curing, not conforming to requirements specified

Concrete subjected to damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration

Poor workmanship likely to result in deficient strength

3.12.3 Testing Concrete Structure for Strength

When there is evidence that strength of concrete structure in place does not meet specification requirements, cores drilled from hardened concrete for compressive strength determination shall be made in accordance with ASTM C 42/C 42M, and as follows:

At least three representative cores shall be taken from each member or area of concrete-in-place that is considered potentially deficient. Location of cores will be determined by the Contracting Officer.

Cores shall be tested after moisture conditioning in accordance with ASTM C 42/C 42M if concrete they represent will be more than superficially wet under service.

Cores shall be air dried, (60 to 80 degrees F with relative humidity less than 60 percent) for 7 days before test and shall be tested dry if concrete they represent will be dry under service conditions.

Strength of cores from each member or area will be considered satisfactory if their average is equal to or greater than 85 percent of the 28-day design compressive strength of the class of concrete.

Core specimens will be taken and tested by the Government. If the results of core-boring tests indicate that the concrete as placed does not conform to the drawings and specification, the cost of such tests and restoration required shall be borne by the Contractor.

Core holes shall be filled solid with patching mortar and finished to match adjacent concrete surfaces.

Concrete work that is found inadequate by core tests shall be corrected in a manner approved by the Contracting Officer.

CONCRETE MIX DESIGN SUBMITTAL FORM

Project: _____

General Contractor: _____

Concrete Supplier: _____

Mix Design (list class or describe use): _____

Reference "Design and Control of Concrete Mixtures" by the Portland Cement Association and "Building Code Requirements for Structural Concrete" by the American Concrete Institute when completing this form. (Submit one data form for each mix design).

MIX DESIGN DATA:

MATERIALS / PROPORTIONS

Cement: _____
Fly Ash: _____ 10 percent minimum
Coarse Aggregate: _____
Fine Aggregate: _____
Water: _____
Water Reducing Admixture: _____
Air Entraining Admixture: _____
Fiber Reinforcement: _____
Other: _____

KEY RATIOS

Water / cementitious ratio: _____
Fly ash / cementitious materials ratio: _____%.
Fine aggregate / total aggregate: _____%.

COMPRESSIVE STRENGTH

Average 28 day compressive strength: _____ psi, supported by one of the following:

Mix design supported by test history.

OR

Mix design proportioned to achieve $f'_{cr} = f'_c + 1200$ psi. (cross out method not selected)

SPECIFIC GRAVITIES

Fine aggregate:

Coarse aggregate:

FRESH CONCRETE PROPERTIES

Slump = _____ in.
Total Air Content = _____ %.
Density / Unit Wt. = _____ pcf.

BATCH WATER

Design mix water to be withheld at batch plant
for discretionary addition at point of use: _____ gal / CY.

REQUIRED ATTACHMENTS:

Check for each item attached.

_____ Concrete compressive strength history.
_____ Cement mill test report(s) and certification - indicate type.
_____ Fly Ash mill test report(s) and certification - indicate class.
_____ Coarse aggregate gradation report.
_____ Coarse aggregate deleterious content and soundness report
- indicate weathering class.
_____ Coarse aggregate shrinkage characteristics test(s).
_____ Fine aggregate gradation report.
_____ Certification that water source is potable.
_____ Admixture manufacturer's data sheets and certifications.
_____ Admixture compatibility certification letter(s).
_____ Fiber reinforcement manufacturer's data sheet and
certification.

Submitted by:

Name and Company

Address _____
Phone Number _____
Date _____
Plant Location _____

Distance from Project _____

Remarks:

-- End of Section --

SECTION 04810

NONBEARING MASONRY VENEER

PART 1 GENERAL

1.1 SUMMARY

This Section includes the following:

Concrete unit masonry.

Products installed but not furnished under this Section include the following:

Steel lintels in unit masonry are specified in Division 5 Section "Structural Steel."

Insulation behind unit masonry is specified in Division 7 Section "Building Insulation."

Hollow metal frames in unit masonry openings are specified in Division 8 Section "Steel Doors and Frames."

1.2 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.3 SYSTEM PERFORMANCE REQUIREMENTS

Provide unit masonry that develops the following installed compressive strengths (f'_m):

For concrete unit masonry: As follows:

$f'_m = 1500 \text{ psi.}$

1.4 SUBMITTALS

SD-01 Literature

Hi-lite all descriptive literature to accomplish identification of specific components/items which are proposed to be furnished. Government will not react to descriptive material/literature which has not been hi-lited, except to reject the Submittal.

SD-02 Product Data

Product data for each different masonry unit, accessory, and other manufactured product indicated.

SD-03 Samples

Samples for verification purposes of the following:

Full-size units for each different exposed masonry unit required showing full range of exposed color, texture, and dimensions to be expected in completed construction.

Include size variation data verifying that actual range of sizes for brick falls within ASTM C 216 dimension tolerances for brick where modular dimensioning is indicated.

SD-04 Samples

Colored masonry mortar samples for each color required showing the full range of colors expected in the finished construction. Label samples to indicate type and amount of colorant used.

Aluminum weep holes/vents painted in color to match mortar color. Accessories embedded in the masonry.

SD-12 LEED Submittals per Section 01352

1. Credit MR 4.1 and 4.2: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products containing recycled content.

Include statements indicating cost for each product having recycled content, excluding labor, equipment and profit.

2. Credit MR 5.1 and 5.2: Submit invoices and documentation indicating manufacturing locations within 500 miles of the project site.

- a. Include statements indicating cost for local/regional material (excluding labor, equipment and profit).
- b. Include statements indicating location of extraction, harvest, or recovery of product components within 500 miles of the project.

1.5 QUALITY ASSURANCE

Unit Masonry Standard: Comply with ACI 530.1/ASCE 6 "Specifications for Masonry Structures," except as otherwise indicated.

Revise ACI 530.1/ASCE 6 to exclude Sections 1.4 and 1.7; Parts 2.1.2, 3.1.2, and 4.1.2; and Articles 1.5.1.2, 1.5.1.3, 2.1.1.1, 2.1.1.2, and 2.3.3.9 and to modify Article 2.1.1.4 by deleting requirement for installing vent pipes and conduits built into masonry.

Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.

Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from

one manufacturer for each cementitious component and from one source and producer for each aggregate.

Field-Constructed Mock-Ups: Prior to installation of unit masonry, erect sample wall panels to further verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mock-ups to comply with the following requirements, using materials indicated for final unit of Work:

Locate mock-ups on one corner of building as directed by Contracting Officer Representative.

Notify Contracting Officer one week in advance of the dates and times when mock-up will be erected.

1.6 DELIVERY, STORAGE, AND HANDLING

Store and handle masonry units off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in an air-dried condition.

Store cementitious materials off the ground, under cover, and in dry location.

Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

Cold-Weather Construction: Comply with referenced unit masonry standard for cold-weather construction and the following:

Do not lay masonry units that are wet or frozen.
Remove masonry damaged by freezing conditions.

Hot-Weather Construction: Comply with referenced unit masonry standard.

PART 2 PRODUCTS

2.1 MANUFACTURERS (Basis of Design)

To comply with LEED credits MR 4.1 and 4.2 and MR 5.1 and 5.2:

KANTA Products, Inc. P.O. Box 96, Three Forks, Montana (406) 285-3261, or equal.

2.2 MATERIALS, GENERAL

Comply with referenced unit masonry standard and other requirements specified in this Section applicable to each material indicated.

2.3 CONCRETE MASONRY UNITS

General: Comply with requirements indicated below applicable to each form of concrete masonry unit required.

Provide special shapes where indicated and as follows:

For lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
Square-edged units for outside corners, except where indicated as bullnose.

Size: Provide concrete masonry units complying with requirements indicated below for size that are manufactured to specified face dimensions within tolerances specified in the applicable referenced ASTM specification for concrete masonry units.

Concrete Masonry Units: Manufactured to specified dimensions of 3/8 inch less than nominal widths by nominal heights by nominal lengths indicated on Drawings.

Provide Type II, non-moisture-controlled units.

Exposed Faces: P.A. Fagenstrom antique linen color.

Where special finishes are indicated, provide units with exposed faces of the following general description matching color and texture of Contracting Officer's sample.

Standard aggregate, split face finish.

Where special patterns are indicated, provide units with exposed faces matching color, texture and pattern of Contracting Officer's sample.

Hollow Load-Bearing Concrete Masonry Units: ASTM C 90, Grade N and as follows:

Unit Compressive Strength: Provide units with minimum average net area compressive strength indicated below:

1900 psi.

Not less than the unit compressive strengths required to produce concrete unit masonry construction of compressive strength indicated.

Weight Classification: Lightweight.

2.4 MORTAR AND GROUT MATERIALS

Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce required mortar color.

Masonry Cement: ASTM C 91.

For colored pigmented mortars use premixed colored masonry cements of formulation required to produce color indicated, or if not indicated, as selected from manufacturer's standard formulations.

For colored aggregate mortars use masonry cement of natural color or white as required to produce mortar color indicated.

Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in this article, combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C 1142.

Hydrated Lime: ASTM C 207, Type S.

Aggregate for Mortar: ASTM C 144, except for joints less than 1/4 inch use aggregate graded with 100 percent passing the No. 16 sieve.

Aggregate for Grout: ASTM C 404.

Colored Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with record of satisfactory performance in masonry mortars.

Water: Clean and potable.

Products: Subject to compliance with requirements, provide one of the following or an equal approved by Contracting Officer:

Colored Masonry Cement:

"Colorbond Custom Color Masonry Cement," Centurion.

"Atlas Custom Color Masonry Cement," Lehigh Portland Cement Co.

"Flamingo Color Masonry Cement," The Riverton Corporation.

Colored Mortar Pigments:

"Centurion Pigments," Centurion.

"True Tone Mortar Colors," Davis Colors, A Subsidiary of Rockwood Industries, Inc.

"SGS Mortar Colors," Solomon Grind-Chem Services, Inc.

2.5 REINFORCING STEEL

General: Provide reinforcing steel complying with requirements of referenced unit masonry standard and this article.

Deformed Reinforcing Wire: ASTM A 496.

Plain Welded Wire Fabric: ASTM A 185.

2.6 JOINT REINFORCEMENT

General: Provide joint reinforcement complying with requirements of

referenced unit masonry standard and this article, formed from the following:

Galvanized carbon steel wire, coating class as required by referenced unit masonry standard for application indicated.

Description: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet, with prefabricated corner and tee units, and complying with requirements indicated below:

Wire Diameter for Side Rods: 0.1483 inch.

Wire Diameter for Cross Rods: 0.1483 inch.

For single-wythe masonry provide type as follows with single pair of side rods:

Ladder design with perpendicular cross rods spaced not more than 16 inches o.c.

Manufacturers: Subject to compliance with requirements, provide joint reinforcement by one of the following or an equal approved by Contracting Officer:

AA Wire Products Co.
Dur-O-Wal, Inc.
Heckman Building Products, Inc.
Hohmann & Barnard, Inc.
Masonry Reinforcing Corp. of America.
National Wire Products Industries.
Southern Construction Products, Inc.

2.7 TIES AND ANCHORS, GENERAL

General: Provide ties and anchors specified in subsequent articles that comply with requirements for metal and size of referenced unit masonry standard and of this article.

Galvanized Carbon Steel Wire: ASTM A 82, coating class as required by referenced unit masonry standard for application indicated.

Galvanized Steel Sheet:

ASTM A 366 (commercial quality) cold-rolled carbon steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153, Class B2 (for unit lengths over 15 inches) and Class B3 (for unit lengths under 15 inches), for sheet metal ties and anchors exposed to the weather and not completely embedded in mortar and grout.

Manufacturers: Subject to compliance with requirements, provide products by one of the following or an equal approved by Contracting Officer:

AA Wire Products Co.
Dur-O-Wal, Inc.
Heckman Building Products, Inc.

Hohmann & Barnard, Inc.
Masonry Reinforcing Corp. of America.
National Wire Products Industries.
Southern Construction Products, Inc.

2.8 BENT WIRE TIES

Individual units prefabricated from bent wire to comply with requirements indicated below:

Tie Shape for Hollow Masonry Units Laid with Cells Vertical:
Rectangular with closed ends and not less than 4 inches wide.

2.9 ADJUSTABLE MASONRY VENEER ANCHORS

General: Provide two-piece assemblies allowing vertical or horizontal differential movement between wall and framework parallel to plane of wall, but resisting tension and compression forces perpendicular to it; for attachment over sheathing to metal studs; and with the following structural performance characteristics:

Structural Performance Characteristics: Capable of withstanding a 100 lbf load in either tension or compression without deforming over, or developing play in excess of, 0.05 inch.

Screw-Attached Masonry Veneer Anchors: Units consisting of wire tie section and metal anchor section complying with the following requirements:

Wire Tie Shape: Triangular.
Wire Tie Length: As required to extend 1-1/2 inches into masonry wythe of veneer face, unless indicated otherwise on Drawings.
Anchor Section: Rib-stiffened sheet metal plate with screw holes top and bottom, 0.0747 inch thick (14 gage).

Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene washer, #10 diameter by length required to penetrate steel stud flange by not less than 3 exposed threads, and with the following corrosion protective coating:

Organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.

Neoprene Gaskets: Screw-attached masonry veneer anchor manufacturer's standard closed cell neoprene gaskets manufactured to fit behind anchor plate and to prevent moisture from penetrating through screw holes to steel studs behind air barrier.

Products: Subject to compliance with requirements, provide one of the following or an equal approved by Contracting Officer:

Screw-Attached Masonry Veneer Anchors:

"D/A 213," Dur-O-Wal, Inc.
"DW-10," Hohmann & Barnard, Inc.

"DW-10HS," Hohmann & Barnard, Inc.

"DW-10-X," Hohmann & Barnard, Inc.

2.10 EMBEDDED FLASHING MATERIALS

Asphalt-Coated Copper Flashing: Manufacturer's standard product consisting of sheet copper of weight per sq. ft. indicated below coated with flexible asphalt.

Weight: 7 oz.

Application: Use where flashing is fully concealed in masonry.

Products: Subject to compliance with requirements, provide one of the following or an equal approved by Contracting Officer:

Asphalt-Coated Copper Flashing:

"Cop-A-Cote," Afco Products Inc.

"Type ACC-Asphalt Bituminous Coated," Phoenix Building Products.

"Coated Copper Flashing," Sandell Manufacturing Co., Inc.

"Copperseal," York Manufacturing, Inc.

2.11 MISCELLANEOUS MASONRY ACCESSORIES

Preformed Control Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

Styrene-Butadiene Rubber Compound: ASTM D 2000, Designation 2AA-805.

Polyvinyl Chloride: ASTM D 2287, General Purpose Grade, Type PVC-65406.

Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

Weep Holes: Provide the following:

Plastic Weep Hole/Vent: One-piece flexible extrusion manufactured from ultraviolet-resistant polypropylene co-polymer, designed to weep moisture in masonry cavity to exterior, sized to fill head joints with outside face held back 1/8 inch from exterior face of masonry, in color selected from manufacturer's standard.

2.12 MASONRY CLEANERS

Proprietary Acidic Cleaner: Manufacturer's standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned:

For masonry not subject to metallic oxidation stains, use formulation consisting of a concentrated blend of surface-acting acids, chelating, and wetting agents.

For masonry subject to metallic oxidation stains, use formulation consisting of a liquid blend of organic and inorganic acids and special inhibitors.

Products: Subject to compliance with requirements, provide the following or an equal approved by Contracting Officer:

"Sure Klean No. 600 Detergent," ProSoCo, Inc.

"Sure Klean No. 101 Lime Solvent," ProSoCo., Inc.

"Sure Klean Vana Trol," ProSoCo, Inc.

2.13 MORTAR AND GROUT MIXES

General: Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

Do not use calcium chloride in mortar or grout.

Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification for job-mixed mortar and ASTM C 1142 for ready-mixed mortar, of types indicated below:

Limit cementitious materials in mortar to portland cement-lime.
For reinforced masonry and where indicated, use type indicated below:

Type N.

For exterior, above-grade loadbearing and nonloadbearing walls and parapet walls; for interior loadbearing walls; for interior nonloadbearing partitions, and for other applications where another type is not indicated, use type indicated below:

Type N.

Colored Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required.

Colored Aggregate Mortar: Produce mortar of color required by use of colored aggregates in combination with selected cementitious materials.

Grout for Unit Masonry: Comply with ASTM C 476 and referenced unit masonry standard.

2.14 SOURCE QUALITY CONTROL

Concrete Masonry Unit Tests: For each type, class, and grade of concrete masonry unit indicated, units will be tested by qualified independent testing laboratory for strength, absorption, and moisture content per ASTM C 140.

PART 3 EXECUTION

3.1 EXAMINATION

Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other specific conditions, and other conditions affecting performance of unit masonry.

Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness indicated.

Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to the opening.

Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting where possible.

Matching Existing Masonry: Match coursing, height of new masonry with existing masonry.

3.3 CONSTRUCTION TOLERANCES

Comply with construction tolerances of referenced unit masonry standard.

3.4 LAYING MASONRY WALLS

Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.

Lay up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.

Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4 inch horizontal face dimensions at corners or jambs.

One-half running bond with vertical joint in each course centered on units in courses above and below.

Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4 inch horizontal face dimensions at corners or jambs.

Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond or 1/3-unit length for one-third running bond; do not

tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly (if required), and remove loose masonry units and mortar prior to laying fresh masonry.

Built-In Work: As construction progresses, build-in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.

At exterior frames insert extruded polystyrene board insulation around perimeter of frame in thickness indicated but not less than 3/4 inch to act as a thermal break between frame and masonry.

Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

Fill cores in hollow concrete masonry units with grout 3 courses (24 inches) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

Lay hollow concrete masonry units as follows:

With full mortar coverage on horizontal and vertical face shells.

Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.

For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.

Cut joints flush for masonry walls to be concealed or to be covered by other materials, unless otherwise indicated.

3.6 CAVITIES/AIR SPACES

Keep cavities/air spaces clean of mortar droppings and other materials during construction. Strike joints facing cavities/air spaces flush.

Tie exterior wythe to backup with individual metal ties. Stagger alternate courses.

Install vents in vertical head joints at the top of each continuous cavity/air space. Space vents and close off cavities/air spaces vertically and horizontally with blocking in manner indicated.

3.7 HORIZONTAL JOINT REINFORCEMENT

General: Provide continuous horizontal joint reinforcement as indicated. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8-inch on exterior side of walls, 1/2-inch elsewhere. Lap reinforcing a minimum of 6 inches.

Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 ANCHORING SINGLE-WYTHE MASONRY VENEER

Anchor single-wythe masonry veneer to metal studs with masonry veneer anchors to comply with the following requirements:

Fasten each anchor section through sheathing to metal studs with 2 metal fasteners of type indicated.

Embed tie section in masonry joints. Provide not less than 1 inch airspace between back of masonry veneer wythe and face of sheathing.

Locate anchor section relative to course in which tie section is embedded to allow maximum vertical differential movement of tie up and down.

Space anchors as indicated but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 1 foot of openings and at intervals around perimeter not exceeding 8 inches.

3.9 MOVEMENT (CONTROL AND EXPANSION) JOINTS

General: Install control and expansion joints in unit masonry where indicated. Build in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

Form control joints in concrete masonry as follows:

Install preformed control joint gaskets designed to fit standard sash block.

3.10 LINTELS

Install steel lintels where indicated.

Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.11 FLASHING/WEEP HOLES

General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to the downward flow of water in the wall, and where indicated.

Prepare masonry surfaces so that they are smooth and free from projections that could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with

adhesive/sealant/tape as recommended by flashing manufacturer before covering with mortar.

Install flashings as follows:

Flashing in masonry veneer walls: Carry flashing up face of sheathing at least 8 inches and behind air infiltration barrier/building paper. Turn down sheet metal flashings at exterior face of masonry to form drip.

Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashings and as follows:

Form weep holes with product specified in Part 2 of this Section.

Form weep holes by keeping head joints free and clear of mortar.

Space weep holes 24 inches o.c.

In uninsulated cavities/air spaces place pea gravel to a height equal to height of first course but not less than 2 inches immediately above flashing embedded in the wall, as masonry construction progresses, to splatter mortar droppings and to maintain drainage.

In insulated cavities/air spaces cover cavity/air space side of open weep holes with copper or plastic insect screening before placing loose-fill masonry insulation in cavity.

3.12 FIELD QUALITY CONTROL

Testing Frequency: Tests and evaluations listed in this article will be performed during construction for each 5000 sq. ft. of wall area or portion thereof.

Grout compressive strength will be sampled and tested per ASTM C 1019.

Prism Test Method: For each type of wall construction indicated, masonry prisms will be tested per ASTM E 447, Method B, and as follows:

Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.

Evaluation of Quality Control Tests: In absence of other indications of noncompliance with requirements, masonry will be considered satisfactory if results from construction quality control tests comply with minimum requirements indicated.

3.13 REPAIRING, POINTING, AND CLEANING

Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.

Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings, and adjacent construction to provide a neat, uniform appearance, prepared for application of sealants.

Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Contracting Officer's approval of sample cleaning before proceeding with cleaning of masonry.

Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.

Clean concrete masonry by means of cleaning method indicated in NCMA TEK 45 applicable to type of stain present on exposed surfaces.

Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

-- End of Section --

SECTION 05095

WELDING STEEL CONSTRUCTION

PART 1 GENERAL

1.1 DEFINITIONS

The following classification Class 1 (highest class) to Class 6 (lowest class) shall indicate the project's class(es) of weld joints.

1.1.1 Class 1 Weld Joints

This covers complete penetration weld joints only. These are weld joints where failure would cause a loss of the system and/or be hazardous to personnel. Class 1 weld joints are highly stressed (dynamic and cyclic loading) and characterized as a single point of failure with no redundancy for the redistribution of stress into another member.

1.1.2 Class 2 Weld Joints

This covers both complete and partial penetration groove weld joints and fillet weld joints. These are weld joints where failure would reduce the overall efficiency of a system but loss of the system or a hazard to personnel would not be experienced.

1.1.3 Class 3 Weld Joints

This covers both complete and partial penetration groove weld joints and fillet weld joints. These are weld joints where failure would not affect the efficiency of a system nor create a hazard to personnel. Class 3 weld joints are connections of secondary members not subject to dynamic action and/or low stressed miscellaneous applications.

1.1.4 Class 4 Weld Joints

This covers weld joints applicable to welding reinforcing steel to primary structural members.

1.1.5 Class 5 Weld Joints

This covers weld joints applicable to welding concrete reinforcing steel splices (prestressing steel excepted), steel connection devices, and inserts and anchors required in concrete construction.

1.1.6 Class 6 Weld Joints

This covers plug and slot weld joints as applicable to the requirements of the project's code(s).

1.2 REFERENCES

The publications listed below form a part of this section to the extent

referenced:

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2004) Structural Welding Code - Steel
AWS D1.3	(1998) Structural Welding Code - Sheet Steel
AWS D1.4	(1998) Structural Welding Code - Reinforcing Steel
AWS D14.1	(1997) Welding of Industrial and Mill Cranes and Other Material Handling Equipment
AWS D14.4	(1997) Classification and Application of Welded Joints for Machinery and Equipment
AWS Z49.1	(1999) Safety in Welding and Cutting

ASTM INTERNATIONAL (ASTM)

ASTM E 165	(2002) Standard Test Method for Liquid Penetrant Examination
ASTM E 709	(2001) Standard Guide for Magnetic Particle Examination

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-06 Test Reports

All records of Non-Destructive Examination shall be submitted in accordance with paragraph entitled, "Acceptance Requirements," of this section.

SD-07 Certificates

The following items shall be submitted in accordance with paragraph entitled, "Other Applications," of this section:

Certified Welding Procedure Specifications (WPS)
Certified Brazing Procedure Specifications (BPS)
Certified Procedure Qualification Records (PQR)
Certified Welder Performance Qualifications (WPQ)
Certified Brazer Performance Qualifications (BPQ)

SD-12 LEED Requirements

1. Credit MR 4.1 and 4.2: Product data indicating percentages by weight of post-consumer and post-industrial recycled content.
 - a. Include statements indicating costs for each product having recycled content.

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

The organization performing this work shall be certified in the following AISC (American Institute of Steel Construction) Quality Certification Program Category Category I Conventional Steel Structures.

Safe welding practices shall be adhered to as per AWS Z49.1.

1.4.2 Welding Documentation

Strictly follow prequalified welding procedures according to AWS requirements.

1.4.2.1 Structural Projects

Component Thickness 1/8 inch and greater: Qualification documents (WPS, PQR, and WPQ) shall be in accordance with AWS D1.1/D1.1M.

Component Thickness Less than 1/8 inch: Qualification documents (WPS, PQR, and WPQ) shall be in accordance with AWS D1.3.

Reinforcing Steel: Qualification documents (WPS, PWR, and WPQ) shall be in accordance with AWS D1.4.

1.4.2.2 Other Applications

The Contractor shall submit for approval to the Contracting Officer two copies of Certified Welding Procedure Specifications (WPS), Certified Brazing Procedure Specifications (BPS) and Certified Procedure Qualification Records (PQR) within ninety calendar days after receipt of Notice to Proceed.

Cranes: Qualification documents (WPS, PQR, and WPQ) shall be in accordance with AWS D14.1.

The Contractor shall submit for approval to the Contracting Officer two copies of Certified Welder Performance Qualifications (WPQ) and Certified Brazier Performance Qualifications (BPQ) within ninety calendar days prior to any employee welding on the project material.

Machinery: Qualification documents (WPS, PQR, and WPQ) shall be in accordance with AWS D14.4.

1.5 HEAT INPUT REQUIREMENTS

1.5.1 Preheat

Welding shall not be done at ambient temperature below 32 degrees F, or when the surfaces are wet or exposed to rain, snow, or high wind. Temperature of the metals in the area where the welding is to be done shall be not less than 50 degrees F. When the ambient conditions are such that the normal temperature of the base metal is below 50 degrees F, the area surrounding the joint shall be preheated to provide a base metal temperature of 100 degrees F for distance of at least 3 inches in all directions from the joint to be welded. For ambient temperatures above 50 degrees F, see Table 1 for specific preheat requirements.

1.5.2 Interpass

In a multipass weld, the interpass temperature is the temperature of the weld metal before the next pass is started. See Table 1 for the specific interpass requirements.

TABLE 1
PREHEAT AND INTERPASS TEMPERATURES

PLATE THICKNESS	PREHEAT	INTERPASS
Over 1	250 degrees F	250 degrees F

1.5.3 Postweld

Weldments shall not be given a postweld heat treatment unless noted in the applicable code qualified/certified welding documentation, WPS and PQR.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 ERECTION

3.1.1 Structural Projects

3.1.1.1 Grade A Fabrication

Weldment shall have Class 1 weld joints and be fabricated in accordance with the requirements of the following applicable section: Dynamically Loaded Structures (Section 9) or Tubular Structures (Section 10) of AWS D1.1/D1.1M.

3.1.1.2 Grade B Fabrication

Weldment shall have Class 2 or higher class weld joints and be fabricated in accordance with the requirements of the following applicable section: Statically Loaded Structures (Section 8) or Tubular Structures (Section 10)

of AWS D1.1/D1.1M.

3.1.1.3 Grade C Fabrication

Weldment shall have Class 3, or higher class weld joints and be fabricated in accordance with the requirements of the following applicable code: AWS D1.3.

Component Thickness 1/8 Inch and Greater: Weld joints and fabrication shall be in accordance with the requirements of AWS D1.1/D1.1M.

Component Thickness Less than 1/8 Inch: Weld joints and fabrication shall be in accordance with the requirements of AWS D1.3.

3.1.1.4 Grade D Fabrication

Weld joints shall be Class 4 or higher class weld joints and shall meet the requirements of AWS D1.1/D1.1M.

3.1.1.5 Grade E Fabrication

Weld joints shall be Class 5 or higher class weld joints and shall meet the requirements of AWS D1.4.

3.1.1.6 Grade F Fabrication

Weld joints shall be Class 6 or higher class weld joints and shall meet the applicable code, AWS D1.1/D1.1M, AWS D1.3, and AWS D1.4 requirements.

3.1.2 Other Applications

3.1.2.1 Cranes

Weld joints and fabrication shall be in accordance with the requirements of AWS D14.1.

3.1.2.2 Machinery

Weld joints and fabrication shall be in accordance with the requirements of AWS D14.4.

3.2 INSPECTION/NON DESTRUCTIVE EXAMINATION (NDE)

3.2.1 Inspection, Repair and Cleaning Schedule

Contractor shall perform fabrication/erection inspections as necessary prior to assembly, during assembly, during welding, and after welding to ensure that materials and workmanship meet the requirements of the contract documents.

Final acceptance of all welded/brazed joints shall be by the Contracting Officer.

Prior to the Contracting Officer's inspection, all slag and scale shall be

removed from all welds. Procedure employed shall not produce notches in either the weld metal or adjacent base metal.

Unacceptable welds shall be immediately repaired and made ready for Government reinspection at no additional cost to the Government.

After weld joints have been satisfactorily completed by the Contractor and accepted by the Contracting Officer, the joint area shall be cleaned to a bright, unpitted, and unscarred surface and then protected in accordance with Section 09920 ARCHITECTURAL PAINTING.

3.2.2 Methods of NDE

Examination/inspection of structural steel weldments shall be performed in accordance with the applicable section of AWS D1.3.

3.2.2.1 Visual Inspection (VT)

Visual Inspection (VT) for cracks and other discontinuities shall be aided by a magnifying lens of 5X-10X power to discern indications or defects. Size and contour of welds shall be measured with suitable gages.

3.2.2.2 Liquid Penetrant Inspection (PT)

Liquid Penetrant Inspection (PT) of welds shall be performed in accordance with the requirements of ASTM E 165.

3.2.2.3 Magnetic Particle Inspection (MT)

Magnetic Particle Inspection (MT) of welds shall be performed in accordance with the requirements of ASTM E 709.

3.2.2.4 Radiographic Inspection (RT)

Radiographic Inspection (RT) of welds shall be performed in accordance with the requirements of PART B, "Radiographic Testing of Groove Welds in Butt Joints," of AWS D1.1/D1.1M.

3.2.2.5 Ultrasonic Inspection (UT)

Ultrasonic Inspection (UT) of welds shall be performed in accordance with the requirements of PART C, "Ultrasonic Testing of Groove Welds," of AWS D1.1/D1.1M.

3.2.3 Levels of Examination

Following requirements shall apply to specific welds as specified herein or on the contract drawings.

3.2.3.1 Level I Examination

Level I Examination shall require 100 percent visual (VT), and 100 percent radiographic (RT) inspection unless specified herein or approved by the Contracting Officer. Where RT is not practical, MT, PT, or UT of the root

pass and the final surface of each weld joint shall be performed.

Each radiograph shall have the following additional information permanently included in the image:

Agency Weld No. (including repair cycle no.)

Agency Drawing No.

Agency View No.

Agency Contract No.

Final interpretation and acceptance of all radiographs of welded joints will be by the Contracting Officer.

3.2.3.2 Level II Examination

Level II examination shall require 100 percent visual (VT), and MT, PT, or UT inspection of the final surface of each weld joint.

3.2.3.3 Level III Examination

Level III examination shall require 100 percent visual (VT) inspection of each weld joint.

3.2.4 Acceptance Requirements

Contractor shall provide all records of Non-Destructive Examination, including radiographic film, to the government for review, seven calendar days after the examination. Examination reports shall be stamped "conform" or "do not conform" to the applicable AWS weld requirements by the testing agency.

3.2.4.1 Structural Projects

Grade A Fabrication: Grade A fabrication shall receive a Level I examination. Weldments shall meet the requirements of Section 3, "Workmanship," Section 9, "Dynamically Loaded Structures" or Section 10, "tubular structures," of AWS D1.1/D1.1M.

Grade B Fabrication: Grade B fabrication shall receive a Level II examination. Weldments shall meet the requirements of Section 3, "Workmanship," Section 8 "Statically Loaded Structures".

Grade C Fabrication: Grade C fabrication shall receive a Level III examination. Weldments shall meet the requirements of the applicable code.

- a. Component Thickness 1/8 Inch and Greater: Weldments shall meet the requirements of the applicable section, 8, 9, or 10, of AWS D1.1/D1.1M.
- b. Component Thickness Less Than 1/8 Inch: Weldments shall meet the requirements of Section 4, "Workmanship," of AWS D1.3.

Grade D, E, and F Fabrication: Grade D, E, and F fabrication shall receive a Level III examination. Weldment shall meet the acceptance requirements of AWS D1.1/D1.1M.

3.2.4.2 Other Applications

Trusses: Welds shall meet a combination Level I, Level II, and Level III requirements.

Cranes: Weldments shall meet the requirements of Section 5, "Workmanship," and Section 8, "Weld Quality and Inspection," of AWS D14.1.

Machinery: Weldments shall meet the requirements of Paragraph 4, "Workmanship," and Paragraph 5, "Quality Control Requirements and Procedures," of AWS D14.4.

3.3 PROTECTION

Contractor shall sufficiently protect machinery, materials, floor, equipment and finishes, adjacent to the welding/brazing operations to prevent any damage from these operations.

-- End of Section --

SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

This Section includes structural steel.

Related Sections: The following Sections contain requirements that relate to this Section:

Division 1 Section "Quality Control" for independent testing agency (provided by the GC) procedures and administrative requirements.

Division 5 Section "Steel Deck" for field installation of shear connectors.

Division 5 Section "Metal Fabrications" for loose steel bearing plates and miscellaneous steel framing.

1.3 SUBMITTALS

General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

SD-03 Product Data for each type of product specified.

SD-02 Shop Drawings detailing fabrication of structural steel components.

Include details of cuts, connections, splices, camber, holes, and other pertinent data.

Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.

Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.

Non-certified fabricator to submit written intention to comply with conditions of 1.4.B.2.a and b including names of firms or persons being retained.

SD-12 LEED Requirements

1. Credit MR 4.1 and 4.2: Product data indicating percentages by weight of post-consumer and post-industrial recycled content.

a. Include statements indicating costs for each product having recycled

content.

Anchor Rod Setting Plan: Draw Anchor Rod Setting Plans at scale matching that of Structural Plans. Show all gridlines. Show all columns graphically and label each column size. For columns that change in size above lowest level show only the label corresponding to the lowest length of column. Dimension the exact location of each column relative to the nearest grid. Show each anchor rod graphically and label the size, projection and type. Dimension the location of each anchor rod relative to the associated column. Indicate top of concrete and bottom of base plate elevations. Use exaggerated scale on columns and anchor rods as necessary to clearly and legibly show dimensions.

Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

SD-06 Mill Test Reports signed by manufacturers certifying that their products, including the following, comply with requirements.

- Structural steel, including chemical and physical properties.
- Bolts, nuts, and washers, including mechanical properties and chemical analysis.
- Direct-tension indicators.
- Shear stud connectors.
- Shop primers.
- Nonshrink grout.

1.4 QUALITY ASSURANCE

Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

Fabricator must participate in the AISC Quality Certification Program and be designated an AISC Certified Plant as follows:

- Category: SBD, conventional steel structures.
- Category: CBD, complex steel building structures.

AISC SBD certification may be waived if the following conditions are satisfied:

- Non-certified fabricator agrees to retain the services of a qualified professional Engineer, registered in the state of jurisdiction, to provide supervision and documentation of quality control during truss fabrication.

Non-certified fabricator agrees to retain the services of an AWS Certified Weld Inspector to perform visual and non-destructive weld tests as directed by the Engineer and submit documentation. (Anticipate visually testing all welds and performing non-destructive testing on 25 percent of welds.) Non-certified fabricator will submit written intention to comply with conditions above, including names of firms or persons being retained with Shop Drawings.

Submit inspection documentation described in 1.4.B.2.a and b. to the Engineer for review at least five working days before truss delivery to job site.

Comply with applicable provisions of the following specifications and documents:

AISC's "Load and Resistance Factor Design (LFRD) Specification for Structural Steel Buildings."
AISC's "Specification for Load and Resistance Factor Design of Single-Angle Members."
AISC's "Seismic Provisions for Structural Steel Buildings."
ASTM A 6 (ASTM A 6M) "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
Research Council on Structural Connections' (RCSC) "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel."

Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.5 DELIVERY, STORAGE, AND HANDLING

Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.6 SEQUENCING

Supply anchorage items to be embedded in or attached to other construction

without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 PRODUCTS

2.1 MATERIALS

Structural Steel Wide Flange Shapes:

High Strength Steel: ASTM A 992.

Steel Plates, Bars, Angles, Channels, M-, S-, and HP- Shapes:

Carbon Steel: ASTM A 36.

Square and Rectangular Hollow Structural Steel (HSS): ASTM A 500 Shaped, Grade B.

Round Hollow Structural Steel (HSS): ASTM A 500, Round, Grade B.

Steel Pipe: ASTM A 53, Type E or S, Grade B.

Finish: Black.

Finish: Galvanized.

Finish: Black, except where indicated to be galvanized.

Shear Connectors: ASTM A 108, Grade 1015 through 1020, headed-stud type, cold-finished carbon steel, AWS D1.1, Type B.

Anchor Rods, Nuts, and Washers: As follows:

Hooked, Headed and Threaded, and Nutted Anchor Rods: ASTM F 1554, Grade 36.

Washers: ASTM A 36.

Nuts: Heavy-Hex Nuts ASTM A 563.

Nonhigh-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); carbon-steel, hex-head bolts; carbon-steel nuts; and flat, unhardened steel washers.

Finish: Plain, uncoated.

Finish: Hot-dip zinc-coating, ASTM A 153, Class C.

Finish: Mechanically deposited zinc-coating, ASTM B 695, Class 50.

High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbonsteel washers.

Finish: Plain, uncoated.

Finish: Hot-dip zinc-coating, ASTM A 153, Class C.

Finish: Mechanically deposited zinc-coating, ASTM B 695, Class 50.

Direct-Tension Indicators: ASTM F 959, Type A 325.

Washers: ASTM F 436.

Finish: Plain, uncoated.
Finish: Mechanically deposited zinc-coating, ASTM B 695, Class 50.
Finish: Mechanically deposited zinc-coating, ASTM B 695, Class 50, epoxy coated.

Twist Off Type Tension Control Bolt Assembly: ASTM F 1852.

Finish: Plain, uncoated.
Finish: Hot-dip zinc-coating, ASTM A 153, Class C.
Finish: Mechanically deposited zinc-coating, ASTM B 695, Class 50.

Welding Electrodes: Comply with AWS requirements.

2.2 PRIMER

Primer: Nonasphaltic primer complying with SSPC's "Painting System Guide No. 7.00."

Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds and repair painting galvanized steel, with dry film containing not less than 93 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.

2.3 GROUT

Nonmetallic, Shrinkage-Compensating Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application, and a 30-minute working time.

2.4 FABRICATION

Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.

Camber structural steel members where indicated.
Identify high-strength structural steel according to ASTM A 6 and maintain markings until steel has been erected.
Mark and match-mark materials for field assembly.
Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

Fabricate architecturally exposed structural steel with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.

Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating, and shop priming.
Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for

architecturally exposed structural steel.

Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

Plane thermally cut edges to be welded.

Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.

Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's printed instructions.

Holes: Provide holes required for securing other work to structural steel framing, for passage of other work through steel framing members, and for venting of closed steel shapes, as shown on Shop Drawings.

Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.

Weld threaded nuts to framing and other specialty items as indicated to receive other work.

2.5 SHOP CONNECTIONS

Shop install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.

Shop install and tighten high-strength bolts according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

Bolts: ASTM A 325 (ASTM A 325M) high-strength bolts, unless otherwise indicated.

Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.

Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.

2.6 SHOP PRIMING

Shop prime steel surfaces, except the following:

Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.

Surfaces to be field welded.

Surfaces to be high-strength bolted with slip-critical connections.

Surfaces to receive sprayed-on fireproofing.

Galvanized surfaces.

Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC Specifications as follows:

SSPC-SP 2 "Hand Tool Cleaning."

SSPC-SP 3 "Power Tool Cleaning."

Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC's "Painting System Guide No. 7.00" to provide a dry film thickness of not less than 1.5 mils.

2.7 GALVANIZING

Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel indicated for galvanizing according to ASTM A 123.

2.8 SOURCE QUALITY CONTROL

Contractor will engage an independent testing and inspecting agency to perform shop inspections and tests and to prepare test reports.

Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements. Provide testing agency with access to places where structural steel Work is being fabricated or produced so required inspection and testing can be accomplished.

Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

Shop-bolted connections will be tested and inspected according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

Direct-tension indicator gaps will be verified to comply with ASTM F 959, Table 2.

In addition to visual inspection, shop-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.

Liquid Penetrant Inspection: ASTM E 165.

Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."

Ultrasonic Inspection: ASTM E 164.

In addition to visual inspection, shop-welded shear connectors will be inspected and tested according to requirements of AWS D1.1 for stud welding and as follows:

Bend tests will be performed when visual inspections reveal either less than a continuous 360-degree flash or welding repairs to any shear connector.

Tests will be conducted on additional shear connectors when weld fracture occurs on shear connectors already tested, according to requirements of AWS D1.1.

PART 3 EXECUTION

3.1 EXAMINATION

Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.

Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

Prepare concrete bearing surfaces for grouting of structural steel. Remove deleterious material and bushhammer or otherwise roughen bearing surface to 1/4-inch amplitude.

3.3 ERECTION

Set structural steel accurately in locations and to elevations indicated and according to AISC Specifications referenced in this Section.

Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

Set base and bearing plates for structural members on shims or setting nuts as required.

Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

Comply with manufacturer's instructions for proprietary grout materials.

Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

Maintain erection tolerances of architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

Level and plumb individual members of structure.

Splice members only where indicated.

Finish sections thermally cut during erection equal to a sheared appearance.

Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

Install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.

Install and tighten high-strength bolts according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

Bolts: ASTM A 325 high-strength bolts, unless otherwise indicated.
Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.

Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

Comply with AISC Specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.

3.5 FIELD QUALITY CONTROL

Owner will engage an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports.

Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.

Correct deficiencies in or remove and replace structural steel that

inspections and test reports indicate do not comply with specified requirements.

Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

Field-bolted connections will be tested and inspected according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

Direct-tension indicator gaps will be verified to comply with ASTM F 959, Table 2.

In addition to visual inspection, field-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.

Liquid Penetrant Inspection: ASTM E 165.

Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."

Ultrasonic Inspection: ASTM E 164.

In addition to visual inspection, field-welded shear connectors will be inspected and tested according to requirements of AWS D1.1 for stud welding and as follows:

Bend tests will be performed when visual inspections reveal either less than a continuous 360-degree flash or welding repairs to any shear connector.

Tests will be conducted on additional shear connectors when weld fracture occurs on shear connectors already tested, according to requirements of AWS D1.1.

3.6 CLEANING

Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils.

Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A 780.

-- End of Section --

SECTION 05210

STEEL JOISTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

This Section includes the following:

- K-series open-web steel joists.
- KCS-series open-web steel joists.
- LH-series longspan steel joists.
- DLH-series deep-longspan steel joists.
- Joist girders.
- Joist accessories.

Related Sections: The following Sections contain requirements that relate to this Section:

- Division 1 Section "Quality Control" for independent testing agency procedures and administrative requirements.
- Division 1 Section 01352 "LEED Requirements."
- Division 3 Section "Cast-in-Place Concrete" for installing anchors set in concrete.
- Division 4 Section "Unit Masonry" for installing anchors set in unit masonry.
- Division 5 Section "Structural Steel" for field quality-control procedures and tests.
- Division 5 Section "Metal Fabrications" for loose, steel bearing plates and miscellaneous steel framing.

1.3 PERFORMANCE REQUIREMENTS

Structural Performance: Engineer, fabricate, and erect joists and connections to withstand design loads within limits and under conditions required.

Design Loads: As indicated.

Design joists to withstand design loads without deflections greater than the following:

- Floor Joists: Vertical deflection of 1/360 of the span.
- Roof Joists: Vertical deflection of 1/240 of the span.
- Roof Joists: Vertical deflection of 1/360 of the span.

Engineering Responsibility: Engage a joist manufacturer who utilizes a

qualified professional engineer to prepare design calculations, shop drawings, and other structural data for steel joists.

1.4 SUBMITTALS

General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

SD-03 Product Data for each type of joist, accessory, and product specified.

SD-02 Shop Drawings showing layout, mark, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, accessories, splice and connection details, and attachments to other units of Work.

Indicate locations and details of anchorage devices and bearing plates to be embedded in other construction.

For joists indicated to comply with certain design loadings, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

SD-07 Material Certificates signed by joist manufacturer certifying that joists comply with SJI's "Specifications."

SD-07 Mill Certificates signed by manufacturers of bolts certifying that their products comply with specified requirements.

SD-08 Welder Certificates, for welds performed outside of the joist manufacturing facility, signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

SD-12 LEED Requirements

1. Credit MR 4.1 and 4.2: Product data indicating percentages by weight of post-consumer and post-industrial recycled content.

a. Include statements indicating costs for each product having recycled content.

1.5 QUALITY ASSURANCE

Manufacturer Qualifications: Engage a firm experienced in manufacturing joists similar to those indicated for this Project and that have a record of successful in-service performance.

Manufacturer must be certified by SJI to manufacture joists conforming to SJI standard specifications and load tables.

SJI Design Standard: Comply with recommendations of SJI's "Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders," applicable to types of joists indicated.

Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel" and AWS D1.3 "Structural Welding Code--Sheet Steel."

Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of joists that are similar to those indicated for this Project in material, design, and extent.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle joists as recommended in SJI's "Specifications."

PART 2 PRODUCTS

2.1 MATERIALS

Steel: Comply with requirements of SJI's "Specifications" for chord and web section material.

Steel Bearing Plates: ASTM A 36.

Anchor Bolts: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6), carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.

Finish: Plain, noncoated.

High-Strength Bolts and Nuts: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.

Finish: Plain, noncoated.

Finish: Hot-dip zinc coating, ASTM A 153, Class C.

Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.

Welding Electrodes: Comply with AWS standards.

Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

2.2 PRIMERS

Primer: SSPC-Paint 15, Type I, red oxide; Federal Specification TT-P-636, red oxide; or manufacturer's standard shop primer meeting the performance requirements of either of these red-oxide primers.

Primer: Fast-curing, lead- and chromate-free, VOC-compliant, universal modified alkyd primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS TT-P-664.

VOC compliance certificate signed by manufacturers certifying compliance of their products with regulations of authorities having jurisdiction over volatile organic compounds (VOC's).

2.3 STEEL JOISTS

Manufacture joists according to SJI's "Specifications," with steel angle top and bottom chord members, of joist types, end arrangements, and top chord arrangements indicated.

Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

Provide holes in chord members where shown for securing other work to steel joists.

Camber K-series steel joists according to SJI's "Specifications."

Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes when joist slope exceeds 1/4-inch in 12 inches (1:48).

2.4 JOIST ACCESSORIES

Bridging: Fabricate bridging as indicated and according to SJI requirements.

Supply additional bridging to ensure stability of structure during construction period.

Steel bearing plates with integral anchorages are specified in Division 5 Section "Metal Fabrications."

Supply ceiling extensions, either extended bottom chord elements or a separate extension unit of sufficient strength to support ceiling construction. Extend ends to within 1/2-inch of finished wall surface, unless otherwise indicated.

Supply miscellaneous accessories, including splice plates and bolts required by the joist manufacturer to complete the joist installation.

2.5 SHOP PAINTING

Do not shop paint joists to receive fireproofing.

Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories to be primed as follows:

Surface Preparation: Either hand tool cleaning, SSPC-SP 2, or power tool cleaning, SSPC-SP 3.

Apply one shop coat of primer to joists and joist accessories to be primed to provide a continuous, dry paint film thickness of not less than 1 mil.

PART 3 EXECUTION

3.1 EXAMINATION

Examine supporting substrates, embedded bearing plates, and abutting structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of joists. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

Do not install joists until supporting construction is in place and secured.

Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's recommendations, and the requirements of this Section.

Before installation, splice joists delivered to Project site in more than one piece.

Space, adjust, and align joists accurately in location before permanently fastening.

Install temporary bracing and bridging, connections, and anchors to ensure joists are stabilized during construction.

Field weld joists to supporting steel framework and steel bearing plates. Coordinate welding sequence and procedure with placing of joists.

Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

Bolt joists to supporting steel framework using carbon-steel bolts, unless otherwise indicated.

Bolt joists to supporting steel framework where required using high-strength structural bolts, unless otherwise indicated.

Comply with the Research Council on Structural Connections' (RCSC) "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.

Install and connect one (1) row of bolted bridging prior to releasing the hoisting lines on all joists with spans for 40 feet or greater.

3.3 FIELD QUALITY CONTROL

Testing Agency: A qualified independent testing agency employed and paid by Contractor will perform field quality-control testing.

Testing agency will report test results promptly and in writing to

Contractor and Architect.

Testing and verification procedures will be required of high-strength bolted connections and field welds.

Correct deficiencies in Work that inspections and test reports have indicated are not in compliance with specified requirements.

Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

Touch Up Painting: Following installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, accessories, bearing plates, and abutting structural steel.

Clean and prepare surfaces by hand tool cleaning, SSPC-SP 2, or power tool cleaning, SSPC-SP 3.

Apply a compatible primer of the same type as the shop primer used on adjacent surfaces.

Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at the time of Substantial Completion.

-- End of Section --

SECTION 05312

STEEL ROOF DECK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

This Section includes the following:

Roof deck.

Related Sections include the following:

Division 1 Section 01352 "LEED Requirements."

Division 5 Section "Structural Steel" for shop- and field-welded shear connectors.

Division 5 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

Division 9 painting Sections for repair painting of primed deck.

1.3 SUBMITTALS

SD-03 Product Data: For each type of deck, accessory, and product indicated.

SD-02 Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

SD-07 Product Certificates: For each type of steel deck, signed by product manufacturer.

SD-07 Welding Certificates.

SD-06 Field Quality-Control Test and Inspection Reports.

SD-06 Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

Power-actuated mechanical fasteners.

Acoustical roof deck.

SD-06 Research/Evaluation Reports: For steel deck.

SD-12 LEED Requirements

1. Credit MR 4.1 and 4.2: Product data indicating percentages by weight of post-consumer and post-industrial recycled content.
 - a. Include statements indicating costs for each product having recycled content.

1.4 QUALITY ASSURANCE

Testing Agency Qualifications: An independent agency (provided by GC) qualified according to ASTM E 329 for testing indicated.

Source Limitations for Electrified Cellular Floor Deck: Obtain cellular floor-deck units and compatible electrical components, such as preset inserts, activation kits, afterset inserts, service fittings, header ducts, and trench header ducts, from same manufacturer.

Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 PRODUCTS

2.1 ROOF DECK

Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:

Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS),

Grade G60 (Z180) zinc coating.
Deck Profile: As indicated.
Profile Depth: 1-1/2 inches.
Design Uncoated-Steel Thickness: As indicated.
Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.
Span Condition: Triple span or more.
Side Laps: Overlapped.

2.2 ACCESSORIES

General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3 inch wide flanges and sloped recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 EXECUTION

3.1 EXAMINATION

Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

Install temporary shoring before placing deck panels, if required to meet deflection limitations.

Locate deck bundles to prevent overloading of supporting members.

Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

Place deck panels flat and square and fasten to supporting frame without warp or deflection.

Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:

Weld Diameter: 3/4 inch, nominal.

Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches apart in the field of roof and 6 inches apart in roof corners and perimeter, based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28 and as indicated.

Weld Washers: Install weld washers at each weld location, as required.

Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter

edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches, and as follows:

Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.

End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

End Joints: Lapped 2 inches minimum.

Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FIELD QUALITY CONTROL

Testing Agency: Contractor will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

Field welds will be subject to inspection.

Testing agency will report inspection results promptly and in writing to Contractor.

Remove and replace work that does not comply with specified requirements.

Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS AND PROTECTION

Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Division 9.

Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Division 9.

Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

-- End of Section --

05400

COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

This Section includes the following:

- Partition steel-stud walls.
- Load-bearing steel-stud walls.
- Steel joists.

Related Sections: The following Sections contain requirements that relate to this Section:

- Division 5 Section "Metal Fabrications" for masonry shelf angles and connections.
- Division 9 Section "Gypsum Board Assemblies" for gypsum board and nonload-bearing metal-stud framing and ceiling-suspension assemblies.
- Division 9 Section "Gypsum Sheathing" for gypsum sheathing applied to exterior steel framing.
- Division 9 Section "Gypsum Board Shaft-Wall Assemblies" for gypsum board and nonload-bearing metal-stud framing assemblies.

1.3 PERFORMANCE REQUIREMENTS

AISI "Specifications": Calculate structural characteristics of cold-formed metal framing according to AISI's "Load and Resistance Factor Design Specification for Cold-Formed Steel Structural Members" and the following:

- Center for Cold-Formed Steel Structures (CCFSS) Technical Bulletin, Vol. 2, No. 1, February 1993 "AISI Specification Provisions for Screw Connections."

Structural Performance: Engineer, fabricate and erect cold-formed metal framing with physical and structural properties as indicated.

1.4 SUBMITTALS

General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

Product data for each type of cold-formed metal framing, accessory, and product specified.

Mill certificates signed by manufacturers of cold-formed metal framing certifying that their products comply with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, and galvanized-coating thickness.

In lieu of mill certificates, submit test reports from a qualified independent testing agency evidencing compliance with requirements.

Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

Product test reports from a qualified independent testing agency evidencing compliance with requirements of the following based on comprehensive testing:

- Expansion anchors.
- Powder-actuated anchors.
- Mechanical fasteners.

Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence cold-formed metal framing's compliance with building code in effect for Project.

SD-12 LEED Requirements

- 1. Credit MR 4.1 and 4.2: Product data indicating percentages by weight of post-consumer and post-industrial recycled content.
 - a. Include statements indicating costs for each product having recycled content.

1.5 QUALITY ASSURANCE

Installer Qualifications: Engage an experienced Installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel" and AWS D1.3 "Structural Welding Code--Sheet Steel."

Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated in the Work include, but are not limited to, the following:

American Studco, Inc.
Angeles Metal Systems.
California Metal Systems, Inc.
Consolidated Fabricators Corp.
Design Shapes in Steel.
Knorr Steel Framing Systems.
Scafco Corporation.
United Construction Supply.
United States Steel.
Western Metal Lath Co.

2.2 MATERIALS

Galvanized-Steel Sheet: ASTM A 653, zinc coated according to ASTM A 525, and as follows:

Coating Designation: G 60.
Grade: Grade A, 33,000 psi minimum yield strength, 20 percent elongation.
Grade: Grade D, 50,000 psi minimum yield strength, 12 percent elongation.

2.3 WALL FRAMING

Steel Studs: Manufacturer's standard C-shaped steel studs of web depths indicated, with lipped flanges, and complying with the following:

Design Uncoated-Steel Thickness: As indicated.
Flange Width: 1-5/8 inches.
Web: Punched.

Steel Track: Manufacturer's standard U-shaped steel track, unpunched, of web depths indicated, with straight flanges, and complying with the following:

Design Uncoated-Steel Thickness: As indicated.

2.4 JOIST FRAMING

Steel Joists: Manufacturer's standard C-shaped steel joists, unpunched, of web depths indicated, with lipped flanges, and complying with the following:

1. Design Uncoated-Steel Thickness: As indicated.
2. Flange Width: 1-5/8 inches minimum.

Steel Joist Track: Manufacturer's standard U-shaped steel joist track, unpunched, of web depths indicated, with straight flanges, and complying with the following:

Design Uncoated-Steel Thickness: As indicated.
Flange Width: 2 inches.

2.5 FRAMING ACCESSORIES

Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33,000 psi.

Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

Supplementary framing.
Bracing, bridging, and solid blocking.
Web stiffeners.
Gusset plates.
Deflection track and vertical slide clips.
Stud kickers and girts.
Joist hangers and end closures.
Reinforcement plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

Steel Shapes and Clips: ASTM A 36, zinc coated by the hot-dip process according to ASTM A 123.

Cast-in-Place Anchor Bolts and Studs: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); carbon-steel bolts; carbon-steel nuts; and flat, unhardened-steel washers. Zinc coated by the hot-dip process according to ASTM A 153.

Expansion Anchors: One piece, wedge-style assembly of indicated sizes of zinc-plated steel.

Follow manufacturer's instructions for installation.

Available Products: Subject to compliance with requirements, products

that may be incorporated in the work include, but are not limited to the following:

Kwik-Bolt II; Hilti, Inc., Tulsa, OK.
Power-Stud; Powers Fastening, Inc., New Rochelle, NY.
Trubolt Wedge; ITW Ramset / Red Head, Wood Dale, IL.

Adhesive (Epoxy) Anchors for Concrete or Grouted Masonry: ASTM A36 corrosion resistant steel threaded rods of indicated diameters and embedded lengths. Chamfer rod ends. Nuts and washers to match rods. Injectable two-component epoxy adhesive, or proprietary resin/hardener adhesive, in side-by-side cartridges. Inject through static mixing nozzle.

Follow manufacturer's instructions for installation.
Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to the following:

HIT HY150 System; Hilti, Inc., Tulsa, OK.
Power-Fast System; Powers Fastening, Inc., New Rochelle, NY.
Epcon System; ITW Ramset / Red Head, Wood Dale, IL.

Adhesive (Epoxy Screen Tube) Anchors for Hollow Masonry: ASTM A36 corrosion resistant steel threaded rods of indicated diameters and embedded lengths. Chamfer rod ends. Nuts and washers to match rods. Low carbon, zinc-plated wire mesh screen tubes. Injectable two-component epoxy adhesive, or proprietary resin/hardener adhesive, in side-by-side cartridges. Inject through static mixing nozzle.

Follow manufacturer's instructions for installation.
Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to the following:

HIT HY20 System; Hilti, Inc., Tulsa, OK.
Power-Fast System; Powers Fastening, Inc., New Rochelle, NY.
Epcon System; ITW Ramset / Red Head, Wood Dale, IL.

Powder-Actuated Anchors: Low velocity powder-driven pins at indicated spacings for anchoring track material to concrete or steel services. 0.14 inch minimum diameter. 1 inch minimum embedded length into concrete, with 2 inch flat washers under head.

Minimum working load in shear in concrete: 335#.
Minimum working load in shear in 1/8-inch thick steel: 600#.

Mechanical Fasteners: Corrosion-resistant coated, self-drilling, self-threading steel drill screws.

Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and a 30-minute working time.

Thermal Insulation: ASTM C 665, Type I, unfaced mineral-fiber blankets produced by combining glass or slag fibers with thermosetting resins.

2.8 FABRICATION

Fabricate cold-formed metal framing and accessories plumb, square, true to line, and with connections securely fastened, according to manufacturer's recommendations and the requirements of this Section.

Fabricate framing assemblies in jig templates.

Cut framing members by sawing or shearing; do not torch cut.

Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.

Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

Locate mechanical fasteners and install according to cold-framed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.

Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to manufacturer's recommendations.

Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or distortion.

Fabrication Tolerances: Fabricate assemblies to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8-inch in 10 feet (1:960) and as follows:

Spacing: Space individual framing members no more than plus or minus 1/8-inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8-inch.

PART 3 EXECUTION

3.1 EXAMINATION

Examine supporting substrates and abutting structural framing for compliance with requirements, including installation tolerances and other conditions affecting performance of cold-formed metal framing. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.

3.3 INSTALLATION, GENERAL

Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

Install cold-formed metal framing and accessories plumb, square, true to line, and with connections securely fastened, according to manufacturer's recommendations and the requirements of this Section.

Cut framing members by sawing or shearing; do not torch cut. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.

Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work. Locate mechanical fasteners and install according to cold-framed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.

Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.

Provide temporary bracing and leave in place until framing is permanently stabilized.

Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and double studs, inaccessible upon completion of framing work.

Fasten reinforcement plate over web penetrations that exceed size of manufacturer's standard punched openings.

Erection Tolerances: Install cold-formed metal framing to a maximum

allowable tolerance variation from plumb, level, and true to line of 1/8-inch in 10 feet (1:960) and as follows:

Space individual framing members no more than plus or minus 1/8-inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at indicated spacings.

Squarely seat studs against webs of top and bottom tracks. Fasten both flanges of studs to top and bottom track. Space studs as indicated.

Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

Align studs vertically where wall-framing continuity is interrupted by floor framing. Where studs cannot be aligned, continuously reinforce track to transfer loads.

Align joists over studs. Where joists cannot be aligned, continuously reinforce track to transfer loads.

Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

Install headers over wall openings wider than the stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

Frame wall openings with not less than a double stud at each jamb of frame as indicated or required by manufacturer.

Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

Where type of supplementary support is not indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or load resulting from item supported.

Install horizontal bridging in stud system, spaced in rows not more than 48 inches apart. Fasten at each stud intersection.

Bridging: Cold-rolled steel channel, clip angle fastened to webs of punched studs or flat steel-sheet straps of width and thickness indicated, fastened to stud flanges.

Install steel-sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom track. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 FABRICATED WALL-PANEL INSTALLATION

Install fabricated wall panels and securely anchor to supporting structure.

Erection Tolerances: Bolt or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints.

Maximum variation in plane and true position between prefabricated assemblies should not exceed 1/16-inch.

3.6 JOIST INSTALLATION

Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated or as recommended by the manufacturer.

Install joists bearing on supporting framing, level, straight, and plumb, adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

Install joists over supporting framing with a minimum end bearing of 1-1/2 inches.

Reinforce ends of joists with web stiffeners, end clips, joist hangers, steel clip angles, steel-stud sections, or as otherwise recommended by manufacturer.

Space joists not more than 2 inches from abutting walls, and as indicated.

Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists where indicated.

Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or by other method recommended by joist manufacturer.

Install web stiffeners to transfer axial loads of walls above.

Install bridging at each end of joists and at intervals indicated. Fasten bridging at each joist intersection as follows:

Bridging: Cold-rolled steel channel, fastened to bottom flange of joists or flat, steel-sheet straps of width and thickness indicated, fastened to bottom flange of joists.

Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 FIELD QUALITY CONTROL

Testing Agency: A qualified independent testing agency employed and paid by Owner will perform field quality-control testing.

Field and shop welds will be subject to inspection and testing.

Testing agency will report test results promptly and in writing to Contractor and Architect.

Remove and replace Work that does not comply with specified requirements.

Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.8 REPAIRS AND PROTECTION

Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanizing repair paint according to ASTM A 780 and the manufacturer's instructions.

Touchup Painting: Wire brush, clean, and paint scarred areas, welds, and rust spots on fabricated and installed prime-painted, cold-formed metal framing.

Touchup painted surfaces with same type of shop paint used on adjacent surfaces.

Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer to ensure that cold-formed metal framing is without damage or deterioration at the time of Substantial Completion.

-- End of Section --

SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 317 (1992) Manual of Steel Construction,
Volume II, Connections

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B18.22.1 (1975; R 1998) Plain Washers

AMERICAN WELDING SOCIETY (AWS)

AWS A5.1 (2003) Specification for Carbon Steel
Electrodes for Shielded Metal Arc Welding

AWS D1.1/D1.1M (2004) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (1996) Square and Hex Bolts and Screws,
Including Hex Cap and Lag Screws (Inch
Series)

ASME B18.21.1 (2000) Lock Washers (Inch Series)

ASME B18.6.3 (1998) Machine Screws and Machine Screw
Nuts

ASTM INTERNATIONAL (ASTM)

ASTM A 1011/A 1011M (2004) Steel, Sheet and Strip, Hot-Rolled,
Carbon, Structural, High-Strength
Low-Alloy and High-Strength Low-Alloy with
Improved Formability

ASTM A 123/A 123M (2002) Standard Specification for Zinc
(Hot-Dip Galvanized) Coatings on Iron and
Steel Products

ASTM A 153/A 153M (2004) Standard Specification for Zinc
Coating (Hot-Dip) on Iron and Steel
Hardware

ASTM A 27/A 27M	(2003) Standard Specification for Steel Castings, Carbon, for General Application
ASTM A 283/A 283M	(2003) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A 307	(2003) Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A 36/A 36M	(2003a) Standard Specification for Carbon Structural Steel
ASTM A 366/A 366M	(1997e1) Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality
ASTM A 446/A 446M	(2003) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality
ASTM A 467/A 467M	(2001) Standard Specification for Machine Coil and Chain
ASTM A 47/A 47M	(1999) Standard Specification for Ferritic Malleable Iron Castings
ASTM A 48/A 48M	(2003) Standard Specification for Gray Iron Castings
ASTM A 500	(2003a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 501	(2001) Standard Specification for Hot-Formed Welded and Seamless Carbon-Steel Structural Tubing
ASTM A 513	(2000) Electric-Resistance-Welded Carbon an Alloy Steel Mechanical Tubing
ASTM A 525	(1993) Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A 526/A 526M	(1990) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality
ASTM A 563	(2004) Standard Specification for Carbon and Alloy Steel Nuts

ASTM A 570/A 570M	(1998) Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
ASTM A 575	(2002) Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM A 786/A 786M	(200b) Hot-Rolled Carbon, Low-Alloy, High Strength Low-Alloy, and Alloy Steel Floor Plates
ASTM B 26/B 26M	(2003) Standard Specification for Aluminum-Alloy Sand Castings
ASTM C 387	(2000e1) Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531	(1988; MBG 531S-89) Metal Bar Grating Manual
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THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 25	(1997) Paint Specification No. 25, Red Iron Oxide, Zinc Chromate, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)
SSPC SP 10	(2000) Joint Surface Preparation, Standard Near-White Metal Blast Cleaning (NACE No. 2)

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS FF-B-588	(Rev D) Bolt, Toggle; and Expansion Sleeve, Screw
FS FF-S-325	(Int Amd 3) Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
FS RR-T-650	(1988d) Treads, Metallic and Non-Metallic, Skid Resistant

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	(2001) Occupational Safety and Health Standards
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1.2 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Fabrication drawings for the following items shall be in accordance with the paragraph entitled, "General Fabrication," of this section.

Structural Steel
Joints
Castings

Installation drawings for Miscellaneous Metal Items shall include location, dimensions, size, and weight or thickness as applicable to the members, type and location of welded connections, location and details of anchorage devices that are to be embedded in cast-in-place concrete and masonry construction, and any other pertinent construction and erection details.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Structural Steel Plates, Shapes, and Bars
Structural Steel Tubing
Hot-Rolled Carbon Steel Bars and Bar Size Shapes
Hot-Rolled Carbon Steel Sheets and Strips
Cold-Rolled Carbon Steel Sheets
Galvanized Carbon Steel Sheets
Gray Iron Castings
Malleable Iron Castings
Raised Pattern Steel Floor Plates
Steel Bar Grating
Access Panels and Frames
Roof Scuttles
Steel Pipe Railing
Wheel Guards
Wire Mesh Partitions
Wire Mesh Window Guards
Anchorage Materials
Paint Materials
Fastening Materials
Miscellaneous Metal Items

SD-04 Samples

Contractor shall submit one full-size sample, each type, for the following. After approval, full-size samples may be used in the construction, provided each sample is clearly identified and its location recorded.

Cast Abrasive Thresholds
Metal Safety Nosing for Concrete Treads
Anchorage Materials
Fastening Materials
Lock Cylinder

SD-07 Certificates

Welding Procedures shall be in accordance with AWS D1.1/D1.1M.

Certificates for Welder Qualifications shall be in accordance with the paragraph entitled, "Qualifications for Welding Work," of this section.

Certificates shall be provided for Miscellaneous Metal Items showing conformance with the referenced standards contained in this section.

SD-08 Manufacturer's Instructions

Manufacturers instructions covering installation of Miscellaneous Metal Items shall be submitted.

SD-12 LEED Requirements per Section 01352

1. Credit MR 4.1 and 4.2: List of proposed materials with recycled content.
 - a. Indicate cost, post-consumer recycled content and post-industrial recycled content for each product having recycled content.
2. Credit EQ 4.2: Submit manufacturer's product data for paints and coatings applied on-site including printed statement of VOC content.

1.4 METALWORK REQUIREMENTS

For items not specifically described in these specifications, materials and workmanship shall conform to the accepted standard practices of the trades. Supplementary parts necessary to complete each item shall be furnished and installed. Anchors, sockets, or fastenings required for securing metal work to other structures shall be furnished to the appropriate trades promptly. Details and specifications of items for which standard products are available are representative guides of minimum requirements for such items. Standard products, generally meeting such requirements, will be accepted subject to approval. Welding shall be continuous along entire area of contact except where tack welding is noted. Tack welding will not be permitted on exposed surfaces. Items specified to be galvanized shall be hot-dip galvanized after fabrication. Weight of coating shall be not

less than 1.25 ounces per square foot of surface.

Templates and patterns for proper fitting of hardware and other accessories shall be used wherever practical.

Substitutions of materials or modification of details, or both, shall be made only when warranted and approved.

1.5 QUALIFICATIONS FOR WELDING WORK

Section 05095 WELDING STEEL CONSTRUCTION applies to work specified in this section.

Welding Procedures shall be in accordance with AWS D1.1/D1.1M. Test specimens shall be made in the presence of Contracting Officer and shall be tested by an approved testing laboratory at the Contractor's expense.

Certification of Welder Qualifications by tests in accordance with AWS D1.1/D1.1M, or under an equivalent approved qualification test shall be submitted. In addition, tests shall be performed on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, an immediate retest of two test welds shall be made and each test weld shall pass. Failure in the immediate retest will require that the welder be retested after further practice or training and a complete set of test welds shall be made.

1.6 DRAINAGE HOLES

Drainage holes shall be drilled to eliminate water traps. Hole locations and diameter of holes shall be 1/2 inch and shown on detail drawings for Contracting Officer's approval. Hole size and locations shall not affect structural integrity.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL PLATES, SHAPES, AND BARS

Plates, shapes, and bars shall conform to ASTM A 36/A 36M.

Plates to be bent or cold formed shall conform to ASTM A 283/A 283M, Grade C.

Products to contain a minimum recycled content of 40%.

2.2 STRUCTURAL STEEL TUBING

Square or rectangular tubing shall be hot formed, welded or seamless, conforming to ASTM A 501.

Products to contain a minimum recycled content of 40%.

2.3 HOT-ROLLED CARBON STEEL BARS AND BAR SIZE SHAPES

Bars and bar sizes shall conform to ASTM A 575, Grade M1020.

Products to contain a minimum recycled content of 40%.

2.4 HOT-ROLLED CARBON STEEL SHEETS AND STRIPS

Sheets and strip shall be uncoated and shall conform to ASTM A 1011/A 1011M.

2.5 COLD-ROLLED CARBON STEEL SHEETS

Sheets shall be uncoated and shall conform to ASTM A 366/A 366M.

2.6 GALVANIZED CARBON STEEL SHEETS

Sheets shall conform to ASTM A 526/A 526M; galvanizing shall conform to ASTM A 525, G90.

2.7 GRAY IRON CASTINGS

Castings shall conform to ASTM A 48/A 48M, Class 30.

2.8 MALLEABLE IRON CASTINGS

Castings shall conform to ASTM A 47/A 47M, Grade 32510 or Grade 35018.

2.9 RAISED PATTERN STEEL FLOOR PLATES

Plates shall be structural-quality steel having a raised figure pattern at regular intervals on the surface, and shall be flatback style carbon steel conforming to ASTM A 786/A 786M, except that the steel shall conform to ASTM A 36/A 36M and pattern shall be No. 1, 2, 3, 4, or 5, as required.

2.10 STEEL BAR GRATING

Grating shall conform to NAAMM MBG 531 steel shall conform to ASTM A 36/A 36M and finish shall be shop-applied paint instead of galvanized. End-banding bars, anchors, and other components shall be provided as required to suit conditions indicated. Steel grating exposed to the weather shall be galvanized after fabrication.

2.11 ANCHORAGE MATERIALS

Threaded-type concrete inserts shall be galvanized ferrous castings having an enlarged base with not less than two nailing lugs, length not more than thickness of concrete section less 3/4 inch, and internally threaded to receive 3/4-inch diameter machine bolt. Ferrous castings shall be ferritic malleable iron conforming to ASTM A 47/A 47M, Grade 32510 or Grade 35018, or may be medium-strength cast steel conforming to ASTM A 27/A 27M, Grade U-60-30. Inserts shall be galvanized after fabrication in accordance with ASTM A 153/A 153M.

Threaded inserts shall not be removable when embedded in 3,000 pounds per square inch (psi) concrete and subjected to a 10,000 pound tension load test in an axial direction.

Carbon steel bolts having special wedge-shape heads, nuts, washers, and shims shall be provided. Such hardware items shall be galvanized in accordance with ASTM A 153/A 153M.

Slotted-type concrete inserts shall be galvanized, pressed steel plate, welded construction, box type with slot designed to receive 3/4-inch diameter square head bolt and to provide lateral adjustment of the bolt. Length of insert body less anchorage lugs shall be not less than 4-1/2 inches. Inserts shall be provided with knockout cover. Steel plate shall be not less than 1/8 inch thick and shall conform to ASTM A 283/A 283M, Grade C. Inserts shall be galvanized after fabrication in accordance with ASTM A 153/A 153M.

Slotted inserts shall not be removable when embedded in 3,000 psi concrete and subjected to a 6,000 pound tension load test in an axial direction.

Masonry anchorage devices shall be expansion shields conforming to FS FF-S-325 Group, Type, and Class as follows:

Lead expansion shields for machine screws and bolts 1/4 inch and smaller shall be head-out embedded-nut type, single-unit class, conforming to Group I, Type 1, Class 1.

Lead expansion shields for machine screws and bolts greater than 1/4 inch shall be head-out embedded-nut type, multiple-unit class, conforming to Group I, Type 1, Class 2.

Toggle bolts shall be tumble-wing type of the class and style best suited for the work, and shall conform to FS FF-B-588, Type II.

2.12 FASTENING MATERIALS

Standard bolts shall be regular hexagon head type, low-carbon steel, coarse thread series, conforming to ASTM A 307.

Nuts shall be plain hexagon, regular style, carbon steel, conforming to ASTM A 563, Grade A.

Lag bolts shall be square head, gimlet point or cone point, carbon steel, conforming to ASME B18.2.1.

Machine screws shall be carbon steel, cross-recess drive, flat-head or countersunk head, conforming to ASME B18.6.3.

Wood screws shall be carbon steel, single thread, flat countersunk head, cross-recess drive, conforming to ASME B18.2.1.

Plain washers shall be round, general-assembly-grade, carbon steel class, conforming to ANSI B18.22.1.

Lockwashers shall be helical spring, carbon steel class, of the style best suited for the work, conforming to ASME B18.21.1.

Electrodes for manual shielded metal arc welding shall meet the

requirements of AWS D1.1/D1.1M, and shall be mild steel electrodes conforming to AWS A5.1, E60 series.

2.13 PAINT MATERIALS

Paint for carbon steel shall be as specified in Division 9. If applied on-site, paints and coatings must also conform to VOC limits set forth in Section 01352 "LEED Requirements."

Primer for carbon steel shall be as specified in Division 9. If applied on-site, paints and coatings must also conform to VOC limits set forth in Section 01352 "LEED Requirements."

2.14 GENERAL FABRICATION

2.14.1 Workmanship

Fabricated Structural Steel shall be in accordance with AISC 317.

Joints shall be milled to a close fit. Corner joints shall be coped or mitered, well-formed, and in true alignment. Joints exposed to the weather shall be formed and fabricated to exclude water.

Castings shall be sound and free from warp or defects that impair strength and appearance. Exposed surfaces shall have a smooth finish and sharp, well-defined lines and arrises. Joints shall be milled to a close fit.

2.14.2 Holes for Other Work

Holes shall be provided as indicated for securing items to metal work.

2.14.3 Galvanizing

Fabricated metal items specified to be galvanized shall be covered with a zinc coating applied by the hot-dip process after fabrication.

Galvanizing of iron and steel hardware shall be in accordance with ASTM A 153/A 153M.

Galvanizing of rolled, pressed, and forged steel shapes, plates, bars, and strip, 1/8-inch thick and heavier, shall be in accordance with ASTM A 123/A 123M.

Galvanizing of assembled steel products shall be in accordance with ASTM A 123/A 123M.

2.14.4 Shop Painting

Fabricated metal work, except metal surfaces embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces shall be primed in accordance with SSPC Paint 25.

2.15 MISCELLANEOUS METAL ITEMS

2.15.1 Access Panels and Frames for Masonry Walls

Panels and frames shall be provided at each pipe space and plumbing chase in masonry walls and at other locations as indicated.

Panels and frames shall be flush panel type for masonry construction, with door size not less than 16 inches by 20 inches.

Frames shall be fabricated from 16 gage, cold-rolled carbon steel sheets with exposed flange not less than 7/8 inch wide, with welded joints and with anchorage for securing to building construction. Panels shall be fabricated from 14-gage, cold-rolled carbon steel sheets, with stiffened edges and with welded attachments. Panels shall be completely assembled with two hinges and one lock per door. Hinges shall be concealed spring type; locks shall be flush-face, turn-screw-operated latch type. Finish shall be prime coat of baked enamel.

2.15.2 Cast Abrasive Thresholds

Thresholds shall be gray iron castings with fluted tread and abrasive grit embedded uniformly into the walking surface at the time of casting. Gray iron castings shall be ASTM Class 20. Abrasive grit shall be No. 20 grain aluminum oxide or silicon carbide or a combination of both. Screws for securing cast-iron thresholds shall be zinc- or cadmium-coated.

Thresholds shall be aluminum-alloy sand castings with fluted tread and abrasive grit embedded uniformly into the walking surface at the time of casting. Aluminum castings shall conform to ASTM B 26/B 26M, Alloy 514.0 or B443.0, Temper F. Abrasive grit shall be 20-grain aluminum oxide. Screws for securing cast aluminum thresholds shall be made of Type 300 series corrosion-resisting, chromium-nickel steel.

Thresholds shall be of the patterns and widths indicated. Lengths shall be as required to accurately fit each opening. Metal thickness shall be not less than 3/8 inch. Thresholds shall be drilled and countersunk to receive flathead screws spaced not more than 3 inches from each threshold end and not more than 15 inches on center; a single row of screw holes for thresholds 5 inches or less in width shall be provided; and a double row of screw holes for thresholds greater than 5 inches in width, with two screw holes at ends and with staggered intermediate screw holes also shall be provided. Threshold ends shall be cut to fit door frame jambs. Thresholds for double doors shall be provided with cutouts to receive bottom bolts.

Thresholds to concrete floor slab shall be secured with lead expansion shields and 1/4-inch flathead machine screws.

2.15.3 Curb Edge Bars

Bars shall be structural steel shapes of sizes indicated, all welded construction, with mitered corners and continuously welded joints. Anchors welded to curbs shall be provided for embedding in concrete or masonry construction; they shall be spaced not more than 6 inches from each curb end and corners and not more than 24 inches on center. Anchors shall be

structural steel bars 3/4-inch wide by 3/8-inch thick with length as required for a minimum embedment of 6 inches in the concrete.

Exterior curb edge bars shall be galvanized. Interior curb edge bars shall be galvanized, where indicated.

2.15.4 Floor Gratings and Frames

Gratings shall be carbon steel with parallel bearing bars either right angle or diagonal cross members, conforming to NAAMM MBG 531. Grating panel sizes and bearing bar sizes shall be as indicated. Each panel shall be provided with end-banding bars, four saddle clip anchors designed to fit over two bearing bars, and four stud bolts, each with a plain washer and nut.

Frames shall be structural steel angles, all-welded construction, and fabricated so that the tops of frames and floor grating finish flush with the finished floor elevation. Anchors welded to the frame shall be provided, spaced not more than 6 inches from ends of frame sections, not more than 6 inches from corners, and not more than 24 inches on center between end and corner anchors. Anchors shall be structural steel bars, 3/4-inch wide by 3/8-inch thick with length as required for a minimum embedment of 6 inches in the concrete.

Grating panels shall be removable. Stud bolts to receive saddle clip anchors shall be field welded to the frame. Notching of bearing bars at supports will not be permitted. Openings in the grating shall be provided as indicated.

Exterior gratings and frames, including fasteners and clips, shall be galvanized. Interior grating and frames, including fasteners and clips, shall be galvanized where indicated.

2.15.5 Floor Plate Covers and Frames

Covers shall be carbon steel plates having a raised figure pattern at regular intervals on the surface, conforming to ASTM A 786/A 786M and pattern shall be No. 1, 2, 3, 4 or 5 as requested by Contracting Officer.

Cover sections shall be the width and thickness indicated. Length shall be limited by total weight not to exceed 100 pounds. Each floor plate cover section shall be provided with two flush lifting rings, (one located at each end of the section). Covers shall be free of sharp edges and burrs. Covers shall be provided with holes to receive flathead machine screws.

Frames shall be structural steel angles and steel bar stops, all-welded construction, and fabricated so that the tops of frames and floor plate covers finish flush with the finished floor elevation. Anchors welded to the frame shall be provided, and shall be spaced not more than 6 inches from ends of frame sections and corners and not more than 24 inches on center. Anchors shall be structural steel bars 3/4-inch wide by 3/8-inch thick with the length as required for a minimum embedment of 6 inches in the concrete. Frames shall be drilled and tapped to receive machine screws.

Plate covers shall be removable and shall be secured to frame with 3/8-inch machine screws spaced not more than 3 inches from each cover end and not more than 12 inches on center. Machine screws shall be zinc-or cadmium-coated. Openings in plate covers shall be provided as indicated.

Exterior plates and frames shall be galvanized. Interior plates and frames shall be galvanized where indicated.

2.15.6 Ladders

Ladders shall be fixed-rail type, located and detailed as indicated and specified. Rungs shall be 3/4-inch, solid-section structural steel rods, spaced 12 inches on center. Side rails shall be structural steel flat bars with rounded edges 2-1/2 inches by 1/2 inch spaced 16 inches apart, and conforming to 29 CFR 1910, Section 27. Rungs shall be fitted into punched holes in the side rails, welded, and ground smooth. Splices and connections shall have a smooth transition with original members without projections that are sharp or more extensive than required for joint strength. Ladders shall be provided with structural steel brackets, drilled to receive anchor bolts, and welded to side rails. Bracket spacing shall not exceed 10 feet on center.

Exterior and interior ladders, including brackets and fasteners, shall be galvanized where indicated.

2.15.7 Ladder Safety Cages

Cages shall be basket guard hoop type, located and detailed as indicated and specified. Cages shall be fabricated from structural steel flat bars and assembled by bolting or welding. Top and bottom hoops and intermediate hoops at intervals of not more than 20 feet between top and bottom hoops, shall be 4 inches by 5/16 inch. Hoops between 4-inch wide hoops shall be 2 inches by 5/16 inch and spaced not more than 4 feet on center. Vertical bars shall be 2 inches by 5/16 inch and spaced not more than 9 inches or 40 degrees on center. Hoops shall be fastened to the steel ladder side rails with 1/2-inch steel bolts or be shop welded.

Exterior and interior ladder safety cages, including fasteners, shall be galvanized.

2.15.8 Loose Steel Lintels

Lintels shall be provided for openings and recesses in masonry walls and partitions as indicated.

Lintels shall be structural steel shapes as indicated. Lintels consisting of more than one member shall be welded together to form one unit. Bearing at each side of openings shall be not less than 6 inches.

Lintels installed in exterior walls shall be galvanized.

2.15.9 Metal Safety Nosing for Concrete Treads

Nosings shall be provided for interior concrete stair treads and concrete

platforms and landings, as indicated.

Nosings shall be nonskid type, cast aluminum-alloy class, with 1/4-inch radius nose lip, conforming to FS RR-T-650 (where abrasive material in top surface is embedded not less than 1.5 millimeter).

Nosings shall be 4-inches wide by 8-inches shorter in length than the width of concrete tread, platform or landing. Each nosing shall be equipped with integrally cast anchors for embedding in fresh concrete. Anchors shall be spaced not more than 4 inches from each nosing end and not more than 15 inches on centers.

2.15.10 Miscellaneous Steel Framing and Supports

Miscellaneous steel framing and supports that do not form a part of the structural steel framework shall be provided to complete the work.

Miscellaneous steel framing and supports shall be fabricated of structural steel plates, shapes, bars, and tubing, of sizes and arrangement indicated.

Exterior and interior fabricated steel framing and supports shall be galvanized as indicated.

2.15.11 Roof Scuttles

Roof scuttles shall be single-leaf type, sized to provide a minimum clear opening of 30 by 36 inches.

Steel sheets shall be prime painted, electro-deposited galvanized, hot-rolled carbon steel sheets; covers and curbs shall be 14 gage, and 22 gage for cover liner.

Steel sheets shall be hot-dip-galvanized carbon steel sheets. Sheet equivalent thickness shall be 0.0785 inch (14 galvanized sheet gage) for covers and curbs and 0.0336 inch (22 galvanized sheet gage) for cover liner.

Cover shall be formed from one piece of the specified steel sheet with 3-inch hemmed edge and corners full welded and ground smooth. Cover shall be insulated with either glass fiber or rigid fiberboard insulation 1 inch thick. Insulation shall be covered and protected by the specified steel sheet cover liner.

Curbs shall be made of the specified steel sheet 12 inches in height, formed with 3-1/2-inch mounting flange having holes for securing to the roof deck. Curb shall be equipped with an integral metal cap flashing made of the same metal and gage as the curb, having corners full welded and ground smooth. Curb shall be insulated on the exterior face with rigid fiberboard insulation 1 inch thick.

Scuttles shall be completely assembled with heavy pintle hinges, either compression-spring operators enclosed in telescopic tubes or enclosed torsion-spring operators; they shall have an automatic locking hold-open arm provided with hand-grip handle, positive snap latch with an operating handle both inside and outside, provisions for padlocking on the inside,

and chloroprene elastomer weatherseal. Hardware shall be zinc- or cadmium-coated.

2.15.12 Safety Chains

Chains, complete with snap fasteners on each end and eye bolts for attachment of chains, shall be provided for each guarded opening where indicated.

Chains shall be galvanized, welded type, proof coil steel chain, 3/16-inch nominal size, with at least 10 links per foot, proof loading not less than 1,000 pounds, zinc-coated, conforming to ASTM A 467/A 467M.

Snap fasteners shall be boat type with strength equivalent to the chain proof loading. Eye bolts for attachment of chains shall be 3/8-inch bolt with 3/4-inch eye diameter and shall have strength equal to the chain proof loading. Safety fasteners and eye bolts shall be galvanized.

Two chains 6 inches longer than the anchorage spacing shall be provided for each guarded opening. Top chain shall be mounted not less than 3 feet 6 inches above the floor and the second chain shall be mounted 2 feet above the floor.

2.15.13 Shelf Angles

Angles attached to concrete framing shall be structural steel angles of the sizes indicated. Angles shall be provided with slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from each shelf angle end and not more than 24 inches on center.

Angles to be installed in exterior walls shall be galvanized.

Wedge-type concrete inserts, complete with fasteners, shall be provided for the attachment of shelf angles to cast-in-place concrete.

2.15.14 Steel Pipe Railings

Steel pipe railings shall include guarding at open-sided areas consisting of top rail, intermediate rail and posts, and handrails at walls, as indicated.

Minimum railings shall be 1-1/2-inch nominal size and standard weight, conforming to ASTM A 500, Grade B, ASTM A 501; or may be 1-1/2-inch nominal size, 2.72 pounds weight per foot round structural-steel tubing.

Joining of post, rails, and corners shall be made by one of the following methods:

Flush-type steel railing fittings, welded and ground smooth, with railing splice locks secured with 3/8-inch hexagonal recessed-head setscrews.

Mitered and welded joints made by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and

grinding smooth. Railing splices shall be butted and reinforced by a tight-fitting interior sleeve not less than 6 inches long.

Railings may be bent at corners instead of joining, provided the bends are made in suitable jigs and that the cylindrical cross section of the pipe is maintained throughout the entire bend.

Removable railing sections shall be provided as indicated.

Kickplates shall be provided between railing posts where indicated. Kickplates shall be steel flat bars 1/4-inch thick by not less than 6 inches high. Kickplates shall be secured as indicated.

Exterior and interior railings, including pipe, fittings, brackets, fasteners and other ferrous metal components where indicated shall be galvanized; interior railings not indicated galvanized shall be black.

2.15.15 Steel Stairs

Steel stairs shall be constructed to conform to the sizes and arrangements indicated. Steel framing, hangers, columns, struts, clips, brackets, bearing plates, and other components shall be provided as required for the support of stairs and platforms.

2.15.15.1 Stair Framing

Stringers shall be structural steel channels or structural steel plates or a combination thereof, as indicated. Exposed ends of stringers shall be closed.

Platform of structural steel channel headers and miscellaneous framing members shall be constructed as indicated. Headers shall be bolted to stringers and newels. Framing members shall be bolted to stringers and headers.

2.15.15.2 Metal Pan Risers, Subtreads, and Subplatforms

Metal pans shall be formed from 12-gage structural steel sheets and shall be made to receive cement fill. Structural steel sheets shall be uncoated, hot-rolled, carbon steel of structural quality having a minimum yield point of 40,000 psi and shall conform to ASTM A 570/A 570M, Grade 40.

Metal pans shall be formed from 12-gage structural steel sheets, galvanized, and shall be made to receive cement fill. Galvanized structural steel sheets shall be hot-dip galvanized, carbon steel structural quality having a minimum yield point of 33,000 psi and shall conform to ASTM A 446/A 446M, Grade A, with zinc coating conforming to ASTM A 525, G90.

Riser and subtread metal pans shall be formed with nosing and sanitary cove as indicated. Tread and riser supporting brackets shall be structural steel angles, of size indicated, welded to stringers. Metal pans shall be secured to brackets with rivets or with welds.

Subplatform metal pans shall be secured to platform framing members with welds.

Metal safety nosings shall be nonskid type, cast aluminum-alloy class with 3/8-inch radius nose lip, conforming to FS RR-T-650. Nosings shall be 4-inches wide by length of tread and landing as applicable. Each nosing shall be equipped with integrally cast anchors for embedding in fresh cement fill. Anchors shall be spaced not more than 4 inches from each nosing end and not more than 15 inches on center.

2.15.15.3 Steel Floor Plate Treads

Steel floor plate shall be carbon steel plate having raised figure at regular intervals on the surface conforming to ASTM A 786/A 786M, and pattern shall be No. 1, 2, 3, 4 or 5, as requested by Contracting Officer.

Treads shall be formed of 1/4-inch thick steel floor plate with nosing and back resistance welded carbon steel mechanical tubing conforming to ASTM A 513, of size indicated, welded to stringers. Treads shall be secured to brackets with welds.

Platforms shall be steel floor plate of the thickness indicated. Nosing matching that on steel floor plate treads shall be provided at landings.

2.15.15.4 Floor Grating Treads and Platforms

Floor grating shall be carbon steel, all-welded, parallel bearing bars with right-angle cross members, conforming to NAAMM MBG 531.

Grating treads shall be open riser type, fabricated from floor grating having the bearing bar size indicated, with steel floor plate nosing on front edge and with steel angle or steel plate carrier at each end for string connections. Treads shall be secured to stringers with bolts.

Platforms shall be fabricated from floor grating having the bearing bar size indicated. Nosing matching that on grating treads shall be provided at all landings. Open-sided edges of floor grating platforms shall be provided with toe plates, and all other edges shall be provided with end-banding bars. Grating shall be secured to platform framing members as indicated.

2.15.15.5 Stair Railings and Handrails

Stair railings and handrails at walls shall be steel pipe railings as specified.

2.15.15.6 Soffit Clips

Stair treads and platforms shall be provided with soffit clips having holes for attaching metal furring for plastered soffits. Clips shall be spaced not more than 12 inches on center.

2.15.15.7 Exterior Stairs

Exterior stairs, including platforms, railings, and other ferrous metal components shall be galvanized.

2.15.15.8 Workmanship

Welding shall be used for joining pieces together. Bolts or similar fastenings shall not appear on finish surfaces. Joints shall be true and tight and connections between parts lightproof tight. Welds shall be continuous and ground smooth.

Stair work shall be erected to line, plumb, square, true, and level. Runs shall register level with floor and platform levels.

2.16 STEEL DOOR FRAMES

Steel door frames shall be made of steel shapes of the sizes and weights indicated. Frames shall be fabricated by welding and shall be uniform, square and true. Built-up members shall be plug welded; exposed joints shall be continuously welded, with welds ground smooth. Steel bar stops shall be 1-1/2 inches by 5/8 inch and shall be plug welded to frames except where stops are indicated to be removable. Removable stops shall be secured to frame with machine screws, uniformly spaced not more than 10 inches on center. Any necessary reinforcement shall be made and the frames shall be drilled and tapped as required for finish hardware.

Anchors shall be provided for securing door frames into adjoining concrete or masonry. Anchors shall be structural steel bars 1/8 inch by 2 inches by length as required for a minimum embedment of 4 inches in the concrete or masonry. Anchors shall be welded to frames. Anchors shall be located on jambs not more than 12 inches from both the bottom and head of frame and at uniformly spaced intermediate intervals not exceeding 30 inches on center between anchors.

Exterior and interior steel door frames shall be galvanized where indicated.

2.17 WHEEL GUARDS

Guards shall be gray iron castings, hollow-core type, of the shape indicated, with wall thickness not less than 3/4 inch, with holes for 7/8-inch diameter countersunk anchor bolts, and with grout holes.

PART 3 EXECUTION

3.1 GENERAL

Fabricated metal work shall be installed in accordance with the approved detail drawings and descriptive data for each item of fabricated metal, and as specified.

Fabricated metal items shall be securely fastened plumb and true to lines and levels.

3.2 ANCHORAGE DEVICES EMBEDDED IN OTHER CONSTRUCTION

Anchorage devices, such as concrete inserts, anchor bolts, and fabricated metal items having integral anchors, which are to be embedded in cast-in-place concrete and masonry construction, shall be delivered in time to be installed before the start of cast-in-place concrete operations and masonry work.

Setting drawings, templates, instructions, and directions shall be provided for the installation of the anchorage devices.

3.3 FASTENING TO CONSTRUCTION-IN-PLACE

Anchorage devices and fasteners shall be provided where necessary for fastening fabricated metal items to construction-in-place. Fastening shall include threaded fasteners for concrete inserts embedded in cast-in-place concrete; masonry anchorage devices and threaded fasteners for solid masonry and concrete-in-place; toggle bolts for hollow masonry and stud partitions; through bolting for masonry and wood construction; lag bolts and wood screws for wood construction; and connections for structural steel. Fastening shall be provided as indicated and as specified. Fastening to wood plugs in masonry or concrete-in-place will not be permitted.

3.4 CUTTING AND FITTING

Cutting, drilling, and fitting required shall be performed for the installation of fabricated metal work. Cutting, drilling, and fitting shall be executed carefully; when required, work shall be fitted in place before fastening.

3.5 SETTING MASONRY ANCHORAGE DEVICES

Masonry anchorage devices shall be set in masonry or concrete-in-place construction in accordance with the anchorage device manufacturer's printed instructions. Holes shall be of the recommended depth and diameter and shall be drilled as recommended by the manufacturer of the particular anchorage device used. Drilled holes shall be left rough, not reamed, and free of drill dust.

3.6 FIELD WELDING

Procedures for manual shielded metal arc welding, the appearance and quality of welds made, and the methods used in correcting welding work shall conform to AWS D1.1/D1.1M, "Workmanship" and "Technique."

Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connection of fabricated metal work in place shall not be permitted. Exposed welds shall be ground smooth.

3.7 THREADED CONNECTIONS

Where exposed to view, bolt and screw heads shall be flat and countersunk, unless otherwise specified. Threaded connections shall be made up tightly so that the threads will be entirely concealed by fitting.

3.8 STEEL PIPE RAILINGS

Railings shall be adjusted prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length. Posts shall be spaced not more than 6 feet on center and shall be plumb in each direction. Posts and rail ends shall be secured to building construction as follows:

Concrete anchorage for posts shall be by means of pipe sleeves set and anchored into the concrete. Sleeves shall be galvanized, standard weight steel pipe not less than 6 inches long and have an inside diameter not less than 1/2 inch greater than the outside diameter of the inserted pipe post. Steel plate closure shall be provided, secured to the bottom of the sleeve, and shall be of width and length not less than 1 inch greater than the outside diameter of the sleeve. After posts have been inserted into sleeves, the annular space between post and sleeve shall be filled solid with molten lead, sulfur, or a quick-setting hydraulic cement. Anchorage joint shall be covered with a steel round flange welded to the post.

Steel anchorage for posts shall be made by means of steel oval flanges, angle or floor type required by conditions, welded to posts and bolted to the structural steel supporting members.

Concrete and masonry anchorage for rail ends shall be by means of steel round flanges welded to rail ends and anchored into the wall construction with lead expansion shields and bolts.

Steel anchorage for rail ends shall be by means of steel oval or round flanges welded to rail ends and bolted to the structural steel members.

Handrails shall be secured to walls by means of wall brackets and wall return fitting at handrail ends. Brackets shall be malleable iron castings with not less than an 3-inch projection from the finished wall surface to the center of the pipe handrail and with the wall plate portion of the bracket drilled to receive one 3/8-inch bolt. Brackets shall be located not more than 60 inches on center. Wall return fittings shall be cast-iron castings, flush-type, with the same projection as that specified for wall brackets. Wall brackets and wall return fittings shall be secured to building construction as follows:

Concrete and solid masonry anchorage shall be by means of bolt anchor expansion shields and lag bolts.

Hollow masonry and stud partition anchorage shall be by means of toggle bolts having square heads.

3.9 STRUCTURAL STEEL DOOR FRAMES

Bottom of frames shall extend below the finish floor elevation and shall be secured to the concrete slab by means of steel angle clips and expansion shields and bolts. Angle clips shall be welded to frames.

3.10 WHEEL GUARDS

Guard shall be anchored to concrete or masonry construction in accordance with the manufacturer's instructions.

Hollow cores shall be filled with air-entrained portland cement concrete having a 28-day compressive strength of not less than 3,000 psi, maximum coarse aggregate size of 3/4 inch. Packaged concrete materials shall conform to ASTM C 387 for normal strength air-entrained concrete. Water shall be potable. Concrete mixing shall be done in a batch-type mechanical mixer equipped with a suitable charging hopper, water storage tank, and water-measuring device. Mixer shall be capable of mixing the concrete ingredients into a uniform mass within the specified mixing time and of discharging the mix without segregation. Each batch of 2 cubic yards or less shall be mixed for not less than 1-1/2 minutes; the mixing time shall be increased 15 seconds for each additional cubic yard or fraction thereof.

Concrete shall be handled from the mixer to the location of final deposits as rapidly as practical by methods that will prevent segregation and loss of concrete mix materials. Concrete shall be deposited continuously.

3.11 WIRE MESH WINDOW GUARDS

Guards shall be mounted on the exterior of the window frame. Subframes shall be anchored to concrete jambs and solid masonry jambs with lead expansion shields and bolts, to wood jambs with lag bolts. Hinges and padlock hasps shall be welded to the subframes and window guard frames. Padlock hasps shall be accessible from the interior and shall be installed on the jamb opposite the hinged jamb.

3.12 COUNTER SHUTTER

Rolling counter shutter with integral frame curtain shall consist of interlocking slats of 0.050-inch thick anodized aluminum, with a tubular aluminum bottom bar with concealed slide bolts and vinyl astragal. Integral frame unit shall be extruded aluminum of 6063 alloy. Hood shall be aluminum not less than 0.040-inch thick. Rolling counter door shall be manually operated with a helical torsion spring counterbalance having a 25 percent safety factor. A key lock shall be provided in sill.

3.13 TOUCHUP PAINTING

After installation of fabricated metal work, the Contractor shall touch up field welds, field bolt heads and nuts, screw heads, damaged galvanized steel, and scarred surfaces on fabricated metal work and on adjacent ferrous metal surfaces. Touchup and repair shall be accomplished as soon as possible after the damage or installation has occurred. Surfaces shall be degreased, as required, prior to subsequent surface preparation. Degreasing shall be accomplished by steam cleaning or washing with a solution of trisodium phosphate in water followed by a fresh water rinse. Cuts, welds, and large damaged areas shall be sandblasted to near white SSPC SP 10. Blasting abrasive shall be sharp silica sand, size 16 to 35 mesh. When sandblasting is prohibited or impractical, mechanical cleaning by needle gun or abrasive disks or wheels shall be used. Minor abrasions and scars where extensive rusting has not occurred shall be rendered clean and dry and touched up without further surface preparation. Repair coating

shall be applied within 6 hours after surface preparation or before rusting or re-contamination occurs. Touchup and repair material shall conform to VOC limits set forth in Section 01352 "LEED Requirements." Application shall be by airless or conventional spray. Compressed air used for blasting and coating shall be free of moisture and oil. Manufacturer's recommended procedures shall be followed.

3.14 RAISED PATTERN FLOOR PLATES

Floor plates, except floor plates indicated as removable, shall be welded to supporting members. Removable plates shall be fabricated to sizes indicated and secured with flush countersunk bolts. Joints in plates shall occur only over supports. Openings in flooring shall be provided as indicated.

3.15 STEEL BAR GRATING

Panels, except panels indicated as removable, shall be welded to supporting members. Removable panels shall be fabricated to sizes indicated and secured with stud bolt anchors welded to supporting member. Anchors shall be designed to fit over two bearing bars, and four anchors shall be provided for each removable panel. Joints in panels shall occur only over supports. Notching of bearing bars at supports to maintain elevations will not be permitted. Openings in flooring shall be provided as indicated.

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SECTION 06100

ROUGH CARPENTRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B18.22.1 (1975; R 1998) Plain Washers

AMERICAN WOOD PRESERVERS BUREAU (AWPB)

AWPB LP 2 (1988) Softwood Lumber, Timber and Plywood
Pressure Treated with Water-Borne
Preservatives for Aboveground Use

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA P5 (2001) Standards for Waterborne
Preservatives

AWPA P8 (2001) Oil-Borne Preservatives

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA E30 (2003) Design/Construction Guide,
Residential and Commercial

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (1996) Square and Hex Bolts and Screws,
Including Hex Cap and Lag Screws (Inch
Series)

ASME B18.6.1 (1981; R 1997) Wood Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A 307 (2003) Standard Specification for Carbon
Steel Bolts and Studs, 60,000 psi Tensile
Strength

ASTM A 36/A 36M (2003a) Standard Specification for Carbon
Structural Steel

ASTM A 525 (1993) Standard Specification for General
Requirements for Steel Sheet, Zinc-Coated
(Galvanized) by the Hot-Dip Process

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST PS 1 (1995) Construction and Industrial Plywood
NIST PS 20 (1999) American Softwood Lumber Standards

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS FF-B-588 (Rev D) Bolt, Toggle; and Expansion
Sleeve, Screw
FS FF-N-105 (Rev B; Int Am 4) Nails, Brads, Staples,
and Spikes: Wire, Cut, and Wrought
FS FF-S-325 (Int Amd 3) Shield, Expansion; Nail,
Expansion; and Nail, Drive Screw (Devices,
Anchoring, Masonry)
FS TT-W-571 (Rev J) Wood Preservation: Treating
Practices

1.2 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-06 Test Reports

Tests for Moisture Content of wood shall be in accordance with American Wood-Preservers' Association. Material tested shall be the same material proposed for use in the project. Moisture test shall be dated no earlier than 3 months prior to the delivery of lumber materials. An additional test report will be required if the materials species or stress grade changes.

Fire-Retardant-Treated Lumber shall be according to the paragraph entitled, "Fire-Retardant-Treated Lumber," of this section.

SD-07 Certificates

Certificates shall be submitted for the following items showing conformance with the referenced standards contained in this section. Certificates for wood-framing materials, shall include grade, species and moisture.

Framing Materials

Anchorage and Fastener Materials
Preservative Treated Lumber

SD-12 LEED Submittals per Section 01352

1. Credit EQ4.1: Manufacturer's product data for construction adhesives and sealants, including printed statement of VOC content.
2. Credit EQ4.4: Composite wood manufacturer's product data for each composite wood product used indicating that bonding agent used contains no urea formaldehyde.
3. Credit MR 4.1 and 4.2: Submit manufacturer's product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content.
 - a. Include statement indicating cost for each product having recycled content.
4. Credit MR 5.1 and 5.2: Submit invoices and documentation showing manufacturing locations within 500 miles of project.
 - a. Include statement indicating cost for each product manufactured within 500 miles of project site.
 - b. Include statements indicating locations of extraction, harvest, or recovery of product components within 500 miles of project site.

1.4 DELIVERY, HANDLING, AND STORAGE

Wood materials shall be securely bundled and shipped with adequate moisture-resistant covers to preclude damage by weather or handling during delivery, when stored, and during construction.

Wood materials that must be stored outdoors before immediate use shall be placed in orderly piles and stored on blocks above ground. Lumber shall be stored in stacks with provision for air circulation within stacks. Material shall be protected from the elements with moisture-resistant covers.

PART 2 PRODUCTS

2.1 WOOD MATERIALS

2.1.1 General Requirements

Each piece of framing lumber, board lumber, and plywood shall bear the trademark and grade identification of the manufacturer's association or the authorized inspection bureau under rules of which the lumber is manufactured and graded.

Softwood lumber shall be seasoned S4S and kiln-dried or air-dried to the specified Moisture Content. Dressed sizes shall conform to NIST PS 20.

Structural framing lumber shall be stress graded, with each piece being rated for strength and stamped to indicate the grade and fiber stress in bending; or it shall be certified with manufacturer's certificate of inspection.

Moisture content shall conform to the rules of the lumber association or the inspection bureau under which the lumber is graded but shall not exceed 15 percent for boards and dimensional lumber 2 inches or less in thickness.

2.1.2 Plywood Sheathing

All interior plywood shall comply with low emitting material LEED Requirements set forth in Section 01352.

Plywood sheathing shall be unsanded exterior-grade sheathing, grade stamped "Ext-DFPA," and manufactured in accordance with NIST PS 1, Group 1.

Interior plywood sheathing shall contain no urea formaldehyde, be fire-retardant treated, tongue-and-groove exterior grade sheathing, 5/8-inch minimum thickness, grade stamped "C-C Ext-DFPA," and manufactured in accordance with NIST PS 1, Group 1. After manufacture, plywood shall be fire-retardant treated as specified under "Fire-Retardant-Treated Lumber."

2.1.3 Preservative Treated Lumber

The following wood members shall be pressure-preservative treated in accordance with FS TT-W-571 or AWPB LP 2. Each piece shall bear the AWPB stamp, indicating point of treatment, preservative symbol, symbol of standard, date of treatment, and moisture content after treatment:

Wood sills, plates, rough bucks, and frames in exterior masonry wall openings

Wall plates and furring in contact with exterior masonry or concrete

Nailers that are set into, or are in contact with, concrete or masonry

Blocking and nailers for roof deck, sub fascia members, roof cants and saddles

Preservative shall be either water-borne, conforming to AWPB P5, or oil-borne conforming, to AWPB P8.

Nailers to receive membrane waterproofing and wood members to receive finish materials shall be treated with a water-borne preservative to eliminate preservative bleed-through at nails.

Wood treated with oil-borne preservatives shall be clean, free from surface oil, and properly seasoned for use.

Wood treated with water-borne preservatives shall be air-dried or kiln-dried to reduce maximum moisture content to 15 percent.

Cut surfaces of preservative-treated materials shall be brush coated with at least two coats of copper naphthenate as specified in AWPB P8.

Treated wood exposed in the final structure shall be free from objectionable odors and shall not be harmful or corrosive to adjacent

materials or anchorages.

2.2 ANCHORAGE AND FASTENER MATERIALS

2.2.1 Nails and Staples

Nails, staples, and tacks shall conform to FS FF-N-105.

Nails for fastening interior wood partitions or rough framing shall be steel wire nails.

Nails for roof blocking, cants, and nailers shall be galvanized.

Nails used to fasten exposed wood fascias or finished wood members exposed to the weather shall be aluminum alloy or galvanized finishing nails.

Power-driven staples shall be galvanized Type III, Style 3.

2.2.2 Bolts, Nuts and Screws

Bolts and nuts shall be carbon steel, galvanized, conforming to ASTM A 307, Grade A.

Wood screws shall be carbon steel, galvanized, conforming to ASME B18.6.1.

Lag screws or lag bolts shall be commercial steel, galvanized, conforming to ASME B18.2.1.

Expansion shields, expansion nails, and drive screw devices shall conform to FS FF-S-325.

Toggle bolts shall conform to FS FF-B-588.

Washers shall be carbon steel, galvanized, general assembly purpose type, conforming to ANSI B18.22.1.

2.2.3 Bar or Strap Anchors

Bar or strap anchors shall be steel conforming to ASTM A 36/A 36M. Hot-dip galvanized coating shall be in accordance with ASTM A 525, G90.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 General

Members shall be framed for the passage of ducts and pipes and shall not be cut, notched, or bored more than one quarter of their depth without approved reinforcement.

Washers shall be provided under bolt heads or nuts in contact with wood. Lumber shall be bored to receive bolts.

Nailers, blocking, and furring shall be furnished in lengths that minimize joints.

3.1.2 Blocking, Cant Strips, and Nailers

Nailing strips, blocking, cant strips, and sub fascia wood members shall be continuous, cut with square ends and in maximum practical lengths.

For bolted connections, sub fascia members shall be fastened to structural steel members or concrete with 1/2-inch bolts at a maximum spacing of 4 feet on center, one bolt near each end of the member. Bolt heads shall be countersunk flush with the surface of the wood. Sub fascia members shall be held to a tolerance of 1/8 inch in 10 feet.

Wood cant strips shall be not less than 4-inches long and set at projections through the roof deck, expansion joints, and fascias.

Perimeter roof blocking, nailers, and cants shall be groove-cut to provide ventilation for insulation. Groove cuts shall be matched for continuity or new vent grooves cut when wide vents are built of more than one width of wood.

Bottom half of nailers shall be cut to provide a net open area equivalent to 10 percent of the edge face.

Wood vents for parapet walls and other vertical surfaces shall be 1-inch nominal thickness, treated boards, installed continuously. Wall side of vent shall be cut to provide a net open area equivalent to 20 percent of the thickness edge.

3.1.3 Wood Grounds

Wood grounds shall be dressed; key beveled; preservative treated; not less than 1-1/2-inches wide; the required thickness to provide for the indicated thickness of plaster; and shall be nailed at edges of plastered areas.

3.1.4 Wood Furring

Furring strips shall be erected plumb and rigid, using wood shims wherever necessary to adjust the face of the furring to a true, even plane to receive finish materials.

Exterior masonry walls shall be furred to receive lath and plaster or dry-wall finish.

Furring shall be 1- by 3-inch continuous strips, 16 inches on center, installed vertically. Furring shall be secured to masonry or concrete with nailing plugs, clips, or masonry nails. Fasteners shall be provided at top and bottom and at 24 inches on center.

Furring strips fastened to hollow structural tile or to concrete masonry units shall be secured by toggle bolts, anchor bolts, or screw expansion sleeves.

Furring for soffits, cornices, offsets, and breaks in walls and ceilings shall be formed with 1- by 4-inch wood strips, 16 inches on center.

Furring, attached to steel bar joists for finished ceilings, shall be 2-by 4-inch lumber, 16 inches on center.

3.1.5 Wood Sheathing

Sheathing shall be 1-inch by 8-inch nominal size boards, installed at 90 degrees to the bearing surface and fastened with at least two 8-penny nails at each bearing.

Plywood sheathing shall be of indicated thickness and installed in accordance with APA E30. Interior plywood shall contain no urea formaldehyde.

-- End of Section --

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SECTION 06200

FINISH CARPENTRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B18.6.1 (1981; R 1997) Screw, Wood

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI Qual Stds (2003) Architectural Casework - General

ASTM INTERNATIONAL (ASTM)

ASTM D 4689 (1999) Standard Specification for
Adhesive, Casein Type

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.18 (2003) Hardware - Materials and Finishes

BHMA A156.6 (2001) Architectural Doors and Trim

BHMA A156.9 (2001) Cabinet Hardware

HARDWOOD PLYWOOD & VENEER ASSOCIATION (HPVA)

HPVA HP-1 (2000) Standard for Hardwood and
Decorative Plywood

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3 (2000) High-Pressure Decorative Laminates

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST PS 1 (1995) Construction and Industrial Plywood

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-1932 (Rev A) Lockset, Rim

FS FF-N-105 (Rev B; Int Am 4) Nails, Brads, Staples,
and Spikes: Wire, Cut, and Wrought

1.2 REFERENCES

Section 01352 "LEED Requirements."

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Fabrication Drawings shall be submitted in accordance with paragraph entitled, "Drawings," of this section.

Installation drawings shall be submitted for the following items in accordance with paragraph entitled, "Installation Paneling," of this section.

Hardwood Plywood Paneling
Counters, Cabinets, and Casework
Wood Trim
Plastic Laminate Counter Tops, Edges and Backsplashes
Shelving

SD-04 Samples

Samples of the following shall be submitted in accordance with paragraph entitled, "Samples," of this section.

Hardwood Plywood
Pre-Finished Plywood
Solid Wood Paneling
Wood Trim
Plastic Laminate
Manufacturer's Standard Color Charts

SD-07 Certificates

Certificates of compliance shall be submitted for the following items showing certification of UL-labeled materials indicating the flame spread, fuel-contributed, and smoke-developed ratings and moisture content of hardwood paneling.

Plywood Paneling
Fasteners and Adhesives
Solid Wood
Counters, Cabinets, and Casework
Cabinet Hardware
Plastic Laminate
Priming and Sealing

SD-12 LEED Submittals per Section 01352

1. Credit EQ 4.1: Manufacturer's product data for adhesives and sealants, including printed statement of VOC content.
2. Credit EQ 4.4: Composite wood manufacturer's product data for each composite wood product used indicating that what the bonding agent used contains no urea formaldehyde.
3. Credits MR 4.1 and 4.2: Manufacturer's product data indicating percentage by weight of post-consumer and post-industrial recycled content for products having recycled content.
 - a. Include statement indicating cost for each product having recycled content.
4. Credit MR 7: Product Data for FSC certified wood.

A copy of the wood supplier's Chain of Custody certificate issued by an FSC-accredited certifying agency; and
A copy of the supplier's invoice detailing the quantities of certified wood products supplied for this project, with the FSC-certified status of each product listed in the individual line items (important); or
A copy of a letter from an FSC-accredited certifying agency corroborating that the products detailed on the wood supplier's invoice originate from certified well-managed forests.

Submission of a Chain of Custody certificate without an invoice or submission of an invoice without a Chain of Custody certificate shall not constitute acceptable documentation.

Proper procedures shall be followed to ensure that FSC-certified wood products are kept separate from non-certified materials and that auditing procedures as mandated by the certifier are complied with.

"Well-managed" shall mean forests that are being managed through professionally-administered forestry management and logging plans that ensure regeneration of desired species so that timber growth equals or exceeds harvesting rates in both quantity and quality over the long term. Other considerations include protecting rivers and streams from degradation, minimizing damage to the forest when harvesting, promoting biodiversity, operating in concert with the lawful interests of local populations, and maximizing both the yield and value of the forest products.

1.4 DELIVERY, HANDLING, AND STORAGE

Contractor shall protect materials from damage during delivery, when stored, and during construction. Damaged and defective materials shall be removed and replaced with new.

Trim, cabinet work, and other finish millwork items shall be delivered and brought into the building only after the building has dried out, following the installation of wet materials, and when there is no danger of damage to materials due to excessive moisture.

Hardboard shall be stored in accordance with manufacturer's directions for at least 48 hours in the room in which they are to be installed. Plywood paneling shall be removed from cartons and stacked flat, with 1-inch stripping under and between each pair of face-to-face panel. Face panels shall be separated by a slipsheet.

1.5 SITE CONDITIONS

Field measurements shall be taken before fabrication and installation of materials to verify and supplement the indicated dimensions.

1.6 DRAWINGS

Fabrication Drawings shall be submitted for finish carpentry materials consisting of fabrication and assembly details to be performed in the factory.

1.7 SAMPLES

The following samples shall be submitted:

At least three sample flitches from each log for architectural-grade, Hardwood Plywood.

Panels of Pre-Finished Plywood and Solid Wood Paneling 12 by 18 inches.

Wood Trim 12-inches.

Plastic Laminate 3 by 6 inches.

Manufacturer's Standard Color Charts showing recommended colors and finishes for finish carpentry materials.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Plywood Paneling

2.1.1.1 Plywood Shelving, Utility Usage

Plywood for utility shelving and for utility usage shall be sanded exterior grade plywood, 3/4-inch thick, graded "B-D Int-DFPA" in accordance with NIST PS 1.

2.1.2 Fasteners and Adhesives

2.1.2.1 Nails and Staples

All nails and staples, whether hand driven or mechanically driven, shall conform to FS FF-N-105.

2.1.2.2 Adhesives

Adhesives for interior millwork and trim shall be moisture-resistant type conforming to ASTM D 4689, Type II, water- and mold-resistant.

Adhesives shall comply with Section 01352 "LEED Requirements" for adhesives.

2.1.2.3 Wood Screws

Wood screws shall be carbon steel or brass, conforming to ANSI B18.6.1. Wood screws exposed to view shall be brass with an oval head with cross recess drive.

2.1.3 Solid Wood

2.1.3.1 Quality and Appearance

Solid wood finish materials shall be Premium Grade in accordance with the AWI Qual Stds Standards.

2.1.3.2 Millwork

Solid Wood Trim shall be 300-S-4, Premium Grade, and milled to the indicated profile. Moldings, joint tolerances, miters, construction quality, and surface finish shall conform to AWI Qual Stds requirements for "Standing and Running Trim & Rails."

Moldings and trim shall conform with FSC certification requirements set forth in Section 01352 "LEED Requirements."

Chair rail to be FSC certified oakwood profile H62C from Architectural Millwork Custom Molding and Paneling (800.685.1331) or equal.

Material shall be furnished in the maximum practical length for the end use.

Material shall be kiln-dried. Moisture content shall not exceed 12 percent at the time of delivery to the building site.

Corners shall be mitered, tightly butted, and secured.

Wood trim shall be carefully selected to match wood doors.

Exposed nailing shall be countersunk finishing nails. Countersunk holes shall be filled with matching wood filler or putty.

Wood trim shall be hand sanded at the jobsite to a smooth clean finish, free of machine or tool marks, abrasions, raised grain, or similar imperfections.

2.2 MANUFACTURED UNITS

2.2.1 Cabinets, Counters, and Casework

2.2.1.1 Materials and Construction

Any composite wood to contain recycled material.

Any composite wood used must contain no urea formaldehyde.

Composite wood for cabinets, counters, shelving, and casework shall meet or exceed the requirements of HPVA HP-1, Grade A. Composite wood shall be of specified thickness and face-veneer species, good two sides. Veneers shall be Type II bonded with water-resistant adhesives. Exposed edges shall receive factory-applied edge banding, same species as the face veneer.

Cabinets, counters, shelving, and casework shall be premium grade and mill built to the quality standards in the AWI Qual Stds for casework.

Flush cabinet doors shall be composite wood with matching solid hardwood edges. Lipped doors shall be hardwood plywood with lumber core. Drawer fronts shall be at least 3/4-inch thick solid wood or edge-banded composite wood with veneer species to match cabinet.

Cabinet doors shall have composite wood core edged with solid hardwood matching face veneer species.

Composite wood to be Dow WoodStalk, or equal.

2.2.2 Cabinet Hardware

2.2.2.1 General Standards

Cabinet finish hardware shall conform to the types and styles of BHMA A156.9. Screws and attachments shall be finished to match the hardware item. Finishes shall be in accordance with BHMA A156.18.

Cabinet hardware shall match finish hardware, as specified in Section 08710, "Door Hardware."

2.2.2.2 Adjustable Shelf Supports and Rests

Shelf rests for use in drilled holes shall be B84021, wrought steel, nickel plated with 1/4-inch diameter pin, 3/8-inch long, overall length 1-1/4 inches

2.2.2.3 Cabinet Hinges

Cabinet hinges shall be wrought steel, designated size and finish and shall conform to BHMA A156.9, as follows:

Full mortise, loose-pin hinges shall be B81021, 5-knuckle, button tip, wrought steel, finish 652 or 639.

Semiconcealed cabinet hinges for flush plywood gates and doors shall be B21201, 5-knuckle, button tip, finish 639 or 652.

2.2.2.4 Cabinet Catches

Cabinet catches shall be B83091, friction catch, with wrought steel case and strike and spring-cushioned rubber rollers.

Magnetic catches shall be B43141, Type 1, aluminum case, minimum 4-pound pull.

2.2.2.5 Pulls

Knob-type pulls shall be 1-1/2-inch diameter, anodized aluminum knob and shank.

2.2.2.6 Drawer Slides

Drawer slides shall be B85072, ball bearing full extension drawer slides for attachment to each side of drawer. Rubber stops shall be provided at striking points.

2.2.2.7 Secret Gate Latch

Secret gate latches shall be cast bronze, Type 1091, single-acting or Type 1092, double-acting.

2.2.2.8 Closet Hanger Bars

Closet hanger bars shall be BHMA A156.6, Type L03131, wrought-brass, nickel-plated, telescoping tubing, 1/32-inch minimum wall thickness. Seamless outer tube diameter shall be not less than 1 inch. Each wall plate shall have at least two screw holes for attachment. Nickel-plated wrought steel center supports shall be provided for spans over 48 inches.

2.2.2.9 Locks

Locks shall conform to FS A-A-1932 and shall be all brass, BHMA A156.18, finish US26D, pin-tumbler type with dead bolt, as follows:

Drawer locks and cabinet locks shall be half-mortise, 5 or more pin tumblers, 1-1/8-inch diameter cylinder, 5/16-inch throw dead bolt with brass strike.

2.2.3 Plastic Laminate

All plastic laminate to Greenguard Indoor air quality certified from the Greenguard Environmental Institute.

Adhesives shall conform to Low Emitting requirements for adhesives in Section 01352 "LEED Requirements."

See Sheet AS.1 for product selection and location for design purposes, products have been selected.

2.2.3.1 Counter Tops, Edges, and Backsplashes

Counter top surface, edges, and backsplash shall be 0.042-inch thick, high-pressure laminated, melamine plastic, post-forming type, conforming to NEMA LD 3, Style D-decorative, Type II, Class 1.

2.2.3.2 Vertical Surfaces

Plastic Laminate surfaces for counter fronts, gates, and paneling shall be 0.031-inch thick, high-pressure laminated, melamine plastic, vertical surface type, conforming to NEMA LD 3, Style D-decorative, Type I, Class 1.

Color, pattern, and finish shall be as selected by the Contracting Officer from samples of the approved manufacturer(s).

2.2.3.3 Backing Sheets

Backing sheets for plastic-laminate panels shall be 0.020-inch minimum thick laminated plastic conforming to NEMA LD 3.

Backing sheets for plastic-laminate veneer panels shall be bonded to the core material with an adhesive as recommended by the plastic laminate manufacturer, and conforming with LEED Low Emitting requirements, Section 01352.

2.2.3.4 Adhesive

Adhesives for plastic-laminate panels shall conform to Low Emitting requirements set forth in Section 01352 "LEED Requirements."

2.3 FINISHING

2.3.1 Priming and Sealing

2.3.1.1 Plywood Paneling

Plywood paneling shall be factory finished, with back surfaces sealed. Sealants to conform to Low Emitting requirements in Section 01352 "LEED Requirements."

2.3.1.2 Cabinets, Casework, and Trim

Mill-fabricated cabinets, casework, and solid wood trim shall be delivered to the project unsealed and ready to receive the specified finish. Scheduled for stain finish shall receive one mill-applied coat of approved stain-sealer of a type compatible with the final finish.

Core material to be Dow WoodStalk, or equal.

Core material to contain no urea formaldehyde and shall contain recycled content material.

PART 3 EXECUTION

3.1 PREPARATION

Paneling and finished millwork items shall be installed only when temperature and humidity conditions approximate the interior conditions that will exist when the building is occupied. Relative humidity in the building at the time of installation of materials shall be within the limits recommended by the manufacturer.

3.2 INSTALLATION PANELING

3.2.1 Wood Trim

Wood trim shall be set straight, plumb and level, closely fitted, and rigidly fastened. Nail heads of exposed work shall be countersunk and the holes filled with matching wood filler.

Joints shall be tight and formed to conceal shrinkage. Shop miters over 4 inches shall be glued and splined.

Furring and framing to receive paneling shall be checked for plumb and true plane surface. Adjustments shall be made before proceeding with the work.

3.2.2 Counters, Cabinets, and Casework

Continuous back panels shall be provided for all counters, cabinets, shelving, and casework. Open-backed or skeleton-framed units will not be accepted. Back panels shall be 1/4-inch minimum thick composite wood or tempered hardboard when painted or concealed. Exposed or semi-exposed backs shall be composite wood of the same veneer as the face of the cabinet.

Exposed backs of counters, desk fronts, partitions, and island or peninsula cabinets shall be 3/4-inch minimum thickness and shall be dadoed and glued under pressure into the cabinet sides. All glues/adhesives to comply with VOC limits of Section 01352 "LEED Requirements."

Cabinet bases shall be constructed of 2 by 4-inch framing, with toe space of the indicated height and depth. Cross rails shall be provided at cabinet ends, points of concentrated loads, and intervals not to exceed 24 inches.

Cut out for sinks shall be of size indicated.

Exposed wood surfaces shall be machine sanded at the mill to the specified standard and then shall receive a final sanding at the site to a smooth clean finish, free of machine or tool marks, abrasions, raised grain, or similar imperfections.

3.2.3 Plastic Laminate Counter Tops, Edges and Backsplashes

Plastic laminate shall be bonded to substrate as specified in paragraph entitled, "Core Materials," or to close-grained hardwood, Graded DFPA "B-D," or better.

Core shall be at least 3/4-inch thick for horizontal applications and at least 1/2-inch thick for vertical application.

Plastic laminate shall be bonded to the approved core material with adhesives as recommended by the laminate manufacturer, and that comply with the Low Emitting requirements in Section 01352 "LEED Requirements."

Exposed edges and ends of counter tops and backsplashes shall be the same

plastic laminate material specified for the counter top. Color shall match that for the counter top. Exposed edges shall be rounded to 1/32-inch radius.

3.2.4 Shelving

Shelving shall be constructed and assembled in accordance with AWI Qual Stds, specified grade.

Uprights and wall cleats shall be solid wood, 1 by 3-inch minimum size, nailed to walls and to shelving with finishing nails.

-- End of Section --

SECTION 07190

WATER REPELLENTS

PART 1 GENERAL

1.1 SUMMARY

This Section includes clear water-repellent coatings for the following vertical and nontraffic horizontal surfaces:

Exterior split-faced block veneer.

Exterior concrete unit masonry (including fence piers).

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 501 (1994) Methods of Test for Exterior Walls

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 259 (2002) Resistance of Concrete to Chloride Ion Penetration

AASHTO T 260 (1997; R 2001) Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials

ASTM INTERNATIONAL (ASTM)

ASTM C 140 (2003) Sampling and Testing Concrete Masonry Units and Related Units

ASTM C 672 (1992) Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals

ASTM D 2369 (2003) Volatile Content of Coatings

ASTM D 3278 (1996e1) Flash Point of Liquids by Small Scale Closed-Cup Apparatus

ASTM E 514 (2002) Water Penetration and Leakage Through Masonry

ASTM E 96 (2000e1) Water Vapor Transmission of Materials

ASTM G 53 (1996) Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1000 Air Contaminants

1.3 SUBMITTALS

Hi-lite all descriptive literature to accomplish identification of specific components/items which are proposed to be furnished. Government will not react to descriptive material/literature which has not been hi-lited, except to reject the Submittal.

Product Data: Include manufacturer's specifications, surface preparation and application instructions, recommendations for water repellents for each surface to be treated, and protection and cleaning instructions. Include data substantiating that materials are recommended by manufacturer for applications indicated and comply with requirements.

Certification by water repellent manufacturer that products supplied comply with local regulations controlling use of VOCs.

Material Test Reports: Indicate and interpret test results for compliance of water repellents with requirements indicated.

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

- a. Manufacturer's qualifications: Minimum five years record of successful in-service experience of water repellent treatments manufactured for concrete masonry application.
- b. Applicator's qualifications: Minimum five years successful experience in projects of similar scope using specified or similar treatment materials and manufacturer's approval for application.

1.4.2 Performance Requirements

- a. Water absorption: ASTM C 140. Comparison of treated and untreated specimens.
- b. Moisture vapor transmission: ASTM E 96. Comparison of treated and untreated specimens.
- c. Water penetration and leakage through masonry: ASTM E 514.

1.4.3 Evidence of Acceptable Variation

If a product proposed for use does not conform to requirements of the referenced specification, submit for approval to the Contracting Officer, evidence that the proposed product is either equal to or better than the

product specified. Include the following:

- a. Identification of the proposed substitution;
- b. Reason why the substitution is necessary;
- c. A comparative analysis of the specified product and the proposed substitution, including tabulations of the composition of pigment and vehicle;
- d. The difference between the specified product and the proposed substitution; and
- e. Other information necessary for an accurate comparison of the proposed substitution and the specified product.

1.5 SAMPLE TEST PANEL

The approved Sample Test Panel will serve as the standard of quality for all other water repellent coating work. Do not proceed with application until the sample panel has been approved by the Contracting Officer.

1.5.1 Sample Test Panel

Prior to commencing work, including bulk purchase and delivery of material, apply water repellent treatment to a minimum 4 feet high by 4 feet long test-panel. Provide a full height expansion joint at mid-panel length. Prepare and seal joint with materials approved for project use.

1.5.1.1 Testing

AAMA 501 Provide field water testing of water repellent treated surfaces in the presence of the Contracting Officer and the water repellent treatment manufacturer's representative.

- a. Apply water repellent to left side of mock-up and allow to cure prior to application of treatment to right side.
- b. Twenty days after completion of application of treatment, test mock-up with 5/8 inch garden hose, with spray nozzle, located 10 feet from wall and aimed upward so water strikes wall at 45 degree downward angle. After water has run continuously for three hours observe back side of mock-up for water penetration and leakage. If leakage is detected make changes as needed and retest.
- c. Coordinate testing procedures and modify project treatment application as required to pass mock-up tests for water penetration and leakage resistance.

1.5.1.2 Approval

Proceed with water repellent treatment work only after completion of field test application and approval of mock-up and tests by the Contracting Officer.

1.5.2 Pre-Installation Meeting

- a. Attend pre-installation meeting required prior to commencement of concrete masonry installation.
- b. Review procedures and coordination required between water repellent treatment work and work of other trades which could affect work to be performed under this section of the work.
- c. Convene additional pre-installation meeting prior to water repellent treatment application for coordination with work not previously coordinated including joint sealants.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver materials in original sealed containers, clearly marked with the manufacturer's name, brand name, type of material, batch number, percent solids by weight and volume, and date of manufacturer. Store materials off the ground, in a dry area where the temperature will be not less 50 degrees F nor more than 85 degrees F.

1.7 SAFETY METHODS

Apply coating materials using safety methods and equipment in accordance with Section 01575N TEMPORARY ENVIRONMENTAL CONTROLS, and the following:

1.7.1 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

- a. The coating manufacturer when using solvents or other chemicals. Use impermeable gloves, chemical goggles or face shield, and other recommended protective clothing and equipment to avoid exposure of skin, eyes, and respiratory system. Conduct work in a manner to minimize exposure of building occupants and the general public.
- b. 29 CFR 1910.1000.
- c. Threshold Limit Values (R) of the American Conference of Governmental Industrial Hygienists.
- d. Manufacturer's material safety data sheets.

1.8 ENVIRONMENTAL CONDITIONS

1.8.1 Weather and Substrate Conditions

Do not proceed with application of water repellents under any of the following conditions, except with written recommendations of manufacturer.

- a. Ambient temperature is less than 40 degrees F.

- b. Substrate faces have cured less than one month.
- c. Rain or temperature below 40 degrees F are predicted for a period of 24 hours before or after treatment.
- d. Earlier than three days after surfaces are wet.
- e. Substrate is frozen or surface temperature is less than 40 degrees F and falling.

1.8.2 Moisture Condition

Determine moisture content of substrate meets manufacturer's requirements prior to application of water repellent material.

1.9 SEQUENCING AND SCHEDULING

1.9.1 Masonry Surfaces

Do not start water repellent coating until all joint tooling, pointing and masonry cleaning operations have been completed. Allow masonry to cure for at least 60 days under normal weather conditions before applying water repellent.

1.9.2 Plaster Surfaces

Do not start water repellent coating until all shrinkage and stress cracks are repaired and sound, all surfaces are free of defects and cleaning operations have been completed. Allow plaster to cure for at least 30 days under normal weather conditions before applying water repellent.

1.9.3 Concrete Surfaces

Do not start water repellent coating until all patching, pointing and cleaning operations have been completed and concrete has cured a minimum of 30 days under normal weather conditions.

1.9.4 Sealants

Do not apply water repellents until the sealants for joints adjacent to surfaces receiving water repellent treatment have been installed and cured.

- a. Water repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.
- b. Provide manufacturers' test results of compatibility.

1.10 INSPECTIONS

Notify the manufacturer's representative a minimum of 72 hours prior to scheduled application of water repellents for field inspection. Inspect surfaces and obtain approval in writing from the manufacturer's

representative prior to any application of any water repellent coating.

1.11 SURFACES TO BE COATED

Coat all exterior surfaces. This includes back faces of parapets, top of walls, edges and returns adjacent to windows and door frames and free standing walls.

1.12 WARRANTY

Provide a warranty, issued jointly by the manufacturer and the applicator of the water repellent treatment against moisture penetration through the treated structurally sound surface for a period of five years. Warranty to provide the material, labor, and equipment necessary to remedy the problem.

At the satisfactory completion of the work, complete the warranty sign, notarize, and submit to the Contracting Officer.

PART 2 PRODUCTS

2.1 MATERIALS

Water repellent solution shall be a clear, non-yellowing, deep-penetrating, VOC compliant solution. Material shall not stain or discolor and shall produce a mechanical and chemical interlocking bond with the substrate to the depth of the penetration.

2.2 WATER REPELLENTS

2.2.1 Siloxanes

Penetrating water repellent. Alkylalkoxysiloxanes that are oligomeric with alcohol, ethanol, mineral spirits, or water.

- a. Solids by weight: ASTM D 2369, 7.5-16.0 percent.
- b. Volatile Organic Content (VOC) after blending: Less than 175 grams per liter.
- c. Density, activated: 8.4 pounds per gallon, plus or minus one percent.
- d. Flash point, ASTM D 3278: Greater than 212 degrees F.

2.3 PERFORMANCE CRITERIA

2.3.1 Siloxanes

- a. Dry time for recoat, if necessary: One to two hours depending on weather conditions.
- b. Penetration: 3/8 inch, depending on substrate.
- c. Water penetration and leakage through masonry, ASTM E 514, percentage reduction of leakage: 97.0 percent minimum

- d. Moisture vapor transmission, ASTM E 96: 47.5 perms or 82 percent maximum compared to untreated sample.
- e. Resistance to accelerated weathering, ASTM G 53. Testing 2,500 hours: No loss in repellency.
- f. Resistance to chloride ion penetration, AASHTO T 259 and AASHTO T 260.
- g. Scaling resistance, ASTM C 672, non-air-entrained concrete: Zero rating, no scaling, 100 cycles treated concrete.

PART 3 EXECUTION

3.1 EXAMINATION

Examine masonry surfaces to be treated to ensure that:

- a. All visible cracks, voids or holes have been repaired.
- b. All mortar joints in masonry are tight and sound, have not been re-set or misaligned and show no cracks or spalling.
- c. Moisture contents of walls does not exceed 15 percent when measured on an electronic moisture register, calibrated for the appropriate substrate.
- d. Concrete surfaces are free of form release agents, curing compounds and other compounds that would prevent full penetration of the water repellent material.

Do not start water repellent treatment work until all deficiencies have been corrected, examined and found acceptable to the Contracting Officer and the water repellent treatment manufacturer. Do not apply treatment to damp, dirty, dusty or otherwise unsuitable surfaces. Comply with the manufacturer's recommendations for suitability of surface.

3.2 PREPARATION

3.2.1 Surface Preparation

Prepare substrates in accordance with water repellent treatment manufacturer's recommendation. Clean surfaces of dust, dirt, efflorescence, alkaline, and foreign matter detrimental to proper application of water repellent treatment.

3.2.2 Protection

Provide masking or protective covering for materials which could be damaged by water repellent treatment.

- a. Protect glass, glazed products, and prefinished products from contact with water repellent treatment.

- b. Protect landscape materials with breathing type drop cloths: plastic covers are not acceptable.

3.2.3 Compatibility

- a. Confirm treatment compatibility with each type of joint sealer within or adjacent to surfaces receiving water repellent treatment in accordance with manufacturer's recommendations.
- b. Mask surfaces indicated to receive joint sealers which would be adversely affected by water repellent treatment where treatment must be applied prior to application of joint sealers.

3.3 MIXING

Mix water repellent material thoroughly in accordance with the manufacturer's recommendations. Mix, in quantities required for that days work, all containers prior to application. Mix each container the same length of time.

3.4 APPLICATION

In strict accordance with the manufacturers written requirements. Do not start application without the manufacturer's representative being present or his written acceptance of the surface to be treated.

3.4.1 Water Repellent Treatment

3.4.1.1 Spray Application

Spray apply water repellent material to exterior surfaces using low-pressure airless spray equipment in strict accordance with manufacturer's printed application, instructions, and precautions. Maintain copies at the job site. Apply flood coat in an overlapping pattern allowing approximately 8 to 10 inch rundown on the vertical surface. Maintain a wet edge at all overlaps, both vertical and horizontal. Hold gun maximum 18 inches from wall.

3.4.1.2 Brush or Roller Application

Brush or roller apply water repellent material only at locations where overspray would affect adjacent materials and where not practical for spray applications.

3.4.1.3 Covered Surfaces

Coat all exterior masonry surfaces including back faces of parapets, tops of walls, edges and returns adjacent to window and door frames, window sills, and free-standing walls.

3.4.1.4 Rate of Application

Apply materials to exterior surfaces at the coverages recommended by the

manufacturer and as determined from sample panel test. Increase or decrease application rates depending upon the surface texture and porosity of the substrate so as to achieve even appearance and total water repellency.

3.4.1.5 Number of Coats

The sample panel test shall determine the number of coats required to achieve full coverage and protection (2 coat minimum).

3.4.1.6 Appearance

If unevenness in appearance, lines of work termination or scaffold lines exist, or detectable changes from the approved sample panel occur, the Contracting Officer may require additional treatment at no additional cost to the Government. Apply any required additional treatment to a natural break off point.

3.5 CLEANING

Clean all runs, drips, and overspray from adjacent surfaces while the water repellent treatment is still wet in a manner recommended by the manufacturer.

3.6 FIELD QUALITY CONTROL

Do not remove drums containing water repellent material from the job site until completion of all water repellent treatment and until so authorized by the Contracting Officer.

3.6.1 Field Testing

AAMA 501. At a time not less than twenty days after completion of the water repellent coating application, subject a representative wall area of the building to the Navy Hose Stream Field Test similar to AAMA 501 hose test to simulated rainfall for a period of three hours. Use a minimum 5/8 inch diameter hose and a fixed lawn sprinkler spray head which will direct a full flow of water against the wall. Place the sprinkler head so that the water will strike the wall downward at a 45 degree angle to the wall. If the inside of the wall shows any trace of moisture during or following the test, apply another coat of water repellent, at the manufacturer's recommended coverage rate to the entire building. Repeat testing and re-coating process until no moisture shows on the inside wall face. Accomplish any required work retesting and re-coating at no additional cost to the Government.

3.6.2 Site Inspection

Inspect treatment in progress by manufacturer's representative to verify compliance with manufacturer instructions and recommendations.

-- End of Section --

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SECTION 07210

BUILDING INSULATION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ASTM INTERNATIONAL (ASTM)

ASTM A 390	(1995; R 2001) Standard Specification for Zinc-Coated (Galvanized) Steel Poultry Fence Fabric (Hexagonal and Straight Line)
ASTM B 479	(2000) Standard Specification for Annealed Aluminum and Aluminum-Alloy Foil for Flexible Barrier Applications, Food Contact and Other Applications
ASTM C 1289	(2001) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM C 553	(2002) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 578	(2003b) Standard Specification for Rigid Cellular Polystyrene Thermal Insulation
ASTM C 665	(2000e1) Standard Specification for Mineral Fiber-Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM D 5359	(1998; R 2004) Standard Specification for Glass Cullet Recovered from Waste for use in Manufacture of Glass Fiber
ASTM E 154	(1999) Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slab, on Walls, or as Ground Cover
ASTM E 96	(2000e1) Standard Test Methods for Water Vapor Transmission of Materials
ASTM F 1667	(2002) Standard Specification for Driven Fasteners: Nails, Spikes, Staples

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS UU-B-790

(1992) Building Paper, Vegetable Fiber:
(Kraft, Waterproofed, Water Repellent and
Fire Resistant)

1.2 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330,
"Submittals," in sufficient detail to show full compliance with the
specification:

SD-03 Product Data

Manufacturer's product data shall be submitted for the following
items:

Glass Fiber Insulation Board
Batts and Rolls
Mineral-Fiber Batts
Mineral-Fiber Flexible Blankets
Blown-In Mineral-Fiber Insulation
Rigid Polystyrene Board
Rigid Polyurethane Board
Vapor Barrier
Vapor Barrier Tape
Water-Vapor Barrier Subgrade Covers
Fasteners
Adhesive
Nails
Staples
Wire Netting
Vapor-Barrier Adhesive

SD-04 Samples

Contractor shall submit the following samples:

Three Glass-Fiber Insulation Board samples, full thickness by
12-inches wide by 12-inches long.

Three Mineral Fiber Batts samples, full size by 12-inches long.

Three Mineral-Fiber Flexible Blankets samples, full size by
12-inches long.

Three Vapor-Barrier samples, 12 by 12 inches.

Three Blown-In Mineral-Fiber Insulation samples, 1/2 cubic foot each.

Vapor Barrier Tape
Water-Vapor Barrier Subgrade Covers
Rigid Polystyrene Board
Rigid Polyurethane Board
Fasteners
Adhesive
Wire Netting

SD-06 Test Reports

Test Reports shall be submitted in accordance with paragraph entitled, "Tests," of this section.

SD-07 Certificates

Certificates shall be submitted for the following items showing conformance with referenced standards contained in this section.

Glass Fiber Insulation Board
Batts and Rolls
Mineral-Fiber Batts
Mineral-Fiber Flexible Blankets
Blown-In Mineral-Fiber Insulation
Rigid Polystyrene Board
Rigid Polyurethane Board
Vapor Barrier
Vapor Barrier Tape
Water-Vapor Barrier Subgrade Covers
Staples
Wire Netting
Fire-Retardant Treated Wood Furring Strips

SD-08 Manufacturer's Instructions

Manufacturer's instructions shall be submitted for installation of the following items:

Fasteners
Pneumatic Blowing Machine
Vapor-Barrier Adhesive

SD-11 Closeout Submittals

Warranty

SD-12 LEED Documentation Submittals per Section 01352.

1. Credit MR 4.1 and 4.2: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products that have recycled content.
 - a. Include statements indicating cost for each product having

recycled content.

2. Credit MR 5.1 and 5.2: List of proposed regionally manufactured materials and regionally extracted, harvested, or recovered materials.

a. Identify each regionally manufactured material, its source, and cost.

b. Identify each regionally extracted, harvested or recovered material, its source, and cost.

1.4 DELIVERY, HANDLING, AND STORAGE

Materials shall be delivered to the project site in their original, unopened packages or containers bearing labels identifying the manufacturer's name, brand name, material, and other information.

Materials shall be stored in their original unbroken packages or containers in a weathertight and dry area, and protected from damage until ready for use.

PART 2 PRODUCTS

2.1 THERMAL-INSULATION MATERIALS

Insulation shall have a minimum recycled content of 25%.

Insulation manufacturer shall be located within a 500 mile radius of the project site.

2.1.1 Glass-Fiber Insulation Board

For informational purposes, a list of known sources for recycled building insulation is provided below. Note that the Contractor is not limited to these sources. An approved product from other sources may be submitted for the Government's approval during construction.

Acceptable manufacturer's include, but are not limited to:

Certain Teed Corporation
Guardian Fiberglass, Inc.
Johns Manville Corp.
Owens-Corning Fiberglass Corporation
Western Fiberglass, Inc.

2.1.1.1 Batts and Rolls

Glass-fiber insulation batts and rolls shall be of nominal thickness and width indicated with an R-19 (at walls). Insulation shall conform to ASTM C 665 for the following:

Type II, Kraft faced insulation

Glass-fiber insulation batts and rolls shall contain a total recovered materials content of 20-25 percent recovered glass cullet. Glass cullet shall conform to ASTM D 5359.

2.1.2 Mineral-Fiber Batts

Mineral-fiber batts shall be of the nominal thickness indicated, width and length as required to suit construction conditions, without membrane facing, conforming to ASTM C 665.

Mineral-fiber batts shall be of the nominal thickness indicated, width and length as required to suit construction conditions, with membrane facing on the principal face, conforming to ASTM C 665.

Mineral-fiber batts shall be of the nominal thickness indicated, width and length as required to suit construction conditions, with an enveloping membrane, conforming to ASTM C 665.

Mineral fiber shall contain a total recovered materials content of 75 percent slag.

2.1.3 Mineral-Fiber Flexible Blankets

Mineral-fiber flexible blankets shall be the nominal thickness indicated, width and length as required to suit construction conditions, blanket form, resilient type, for use below and above ambient, conforming to ASTM C 553, and the following:

Blankets shall have a factory-applied vapor-barrier facing on one side with 2 inch nailing tabs on both edges. Vapor barriers shall be fire-retardant, high-vapor transmission, and aluminum foil laminated to creped paper type, conforming to ASTM B 479.

Mineral fibers shall be the textile type.

Nominal density shall be 3/4 pound per cubic foot.

Mineral fiber shall contain a total recovered materials content of 75 percent slag.

2.1.4 Rigid Polystyrene Board

Rigid polystyrene board shall be of thickness indicated and shall be extruded polystyrene conforming to ASTM C 578, Type IV.

Rigid polystyrene board shall contain a minimum content of 9 percent of recovered materials.

2.1.5 Rigid Polyurethane Board

Rigid polyurethane board shall be of thickness indicated and shall conform to ASTM C 1289.

Rigid polyurethane board shall contain a minimum content of 9 percent of recovered materials.

2.1.6 Vapor Barrier

Vapor barrier shall be fire-retardant, high-vapor transmission and aluminum-foil-laminated-to-creped-paper type, conforming to ASTM B 479.

2.1.7 Vapor-Barrier Tape

Vapor-barrier tape shall be not less than 2 inches wide with a fire-retardant pressure-sensitive adhesive coating on one face. Vapor-barrier material shall be fire-retardant, high-vapor transmission and aluminum-foil-laminated-to-creped-paper type, conforming to ASTM B 479.

2.1.8 Water-Vapor Barrier Subgrade Covers

Water-vapor barrier subgrade covers shall be resistant to decay when tested in accordance with ASTM E 154, shall have a water-vapor permeance after exposure in the resistance-to-decay test not exceeding 0.5 perm when tested in accordance with ASTM E 96, Water Method, and shall be one of the following materials:

Clear polyethylene sheeting, 0.008 inch thick

Polyethylene-coated barrier paper consisting of 0.002 inch thick polyethylene film laminated to one surface of rot-resistant, water-resistant, uncreped and reinforced barrier paper; paper shall conform to FS UU-B-790, Type I, Grade A, Style 4.

Asphalt-core board, surfaced both sides with asphalt-saturated and asphalt-coated felt, weighing not less than 60 pounds per 100 square feet, and not less than 1/8 inch thick

2.2 FASTENING MATERIALS

2.2.1 Fasteners

Fasteners shall have a 2- by 2 inch perforated plate, minimum 3/4 inch wide prong, of sufficient length to bend to the bottom of the notch. Fasteners shall be cold-rolled carbon steel, zinc coated. Washers shall be 1-1/2 inch diameter, slotted type, zinc coated.

2.2.2 Adhesive

Adhesive shall have a bonding strength of 70 pounds per clip after a 3-day drying time at 70 degrees F and shall have a temperature range of minus 20 degrees to plus 225 degrees F. Interior adhesives to comply with LEED VOC requirements listed in Section 01352.

2.2.3 Nails

Nails shall be zinc-coated steel, common style, of the size required to suit the application, conforming to ASTM F 1667.

2.2.4 Staples

Staples shall be galvanized steel, flat top crown, of the size required to

suit the application, conforming to ASTM F 1667.

2.2.5 Wire Netting

Wire netting shall be hexagonal zinc-coated steel poultry netting having a 1 inch mesh size and 0.034 inch-diameter (20-gage) wire, conforming to ASTM A 390.

2.2.6 Vapor-Barrier Adhesive

Vapor-barrier adhesive shall be fire resistant, suitable for bonding laps in the vapor-barrier material, and as recommended by the manufacturer of each type of vapor-barrier material used in the work.

2.2.7 Sand

Sand for ballast over water-vapor barrier subgrade covers in crawlspaces shall be natural sand.

PART 3 EXECUTION

3.1 GENERAL

Building insulation shall be installed in accordance with approved descriptive data and as specified.

Insulation material shall be cut and fit as necessary to fully insulate small areas between closely spaced framing members and to accommodate piping, conduit, outlet boxes, and other construction penetrating the insulation material.

Vapor barriers, both those affixed to the principal face of the insulation material and those separately attached, shall be installed to provide a continuous vapor-barrier seal. Tears, breaks, or ruptures that might interfere with the effectiveness of the vapor barrier shall be prevented.

3.2 CONDITIONS AT BUILDING

Insulation shall be installed only after building construction has progressed to the point that inclement weather will not damage or wet the insulation material.

Electrical wiring, plumbing, and other concealed work shall be completed and approved prior to the start of building insulation work.

3.3 PREPARATION OF SURFACES

Surfaces on which thermal-insulation materials are to be applied shall be clean, smooth, dry, and free from projections that might puncture the vapor barriers. Condition of surfaces shall be inspected and approved prior to the start of building insulation work.

Construction shall be supplemented with nailers, furring strips, or other supporting members to support the insulation in its proper location.

3.4 PERIMETER INSULATION SYSTEM

Perimeter insulation applied to foundation walls shall be installed before the start of drainage-fill placing operations. Cellular plastic boards shall be applied to the interior side of outside foundation walls where indicated and shall extend the indicated dimension from the top of the foundation wall. Cellular plastic boards shall be secured to the foundation wall surface by means of spot-applied bonding adhesive for cellular plastic boards; the bonding adhesive shall be applied in accordance with the adhesive manufacturer's printed directions. Cellular plastic boards shall be applied in a horizontal position with ends and sides closely butted together and with vertical joints broken.

Perimeter insulation applied on horizontal surfaces shall be installed after the completion of drainage fill-placing operations. Cellular plastic boards shall be applied horizontally under concrete slabs on the ground where indicated and shall extend the indicated dimension in from the exterior wall. Cellular plastic boards shall be installed with ends and sides closely butted together and the surface leveled to finish flush with the drainage-fill surface. Cellular plastic boards shall be protected by covering horizontal surfaces with water-vapor barrier subgrade covers. Subgrade cover sheets shall be laid with not less than 6 inch laps at edges and ends. Lapped joints shall be sealed with adhesive.

3.5 WALL INSULATION SYSTEM

Glass-fiber insulation batts and rolls shall be placed between wall and ceiling framing members, fitting snugly against framing members. Insulation shall be cut to required length for each space to be insulated.

Mineral-wool batts shall be placed between the wall framing members with batts fitting snugly against framing members. Batts shall be cut to the required length for each space to be insulated, allowing sufficient length for attachment at top and bottom when installed between wall framing members and for snugly butting together when installed between ceiling framing members. When plumbing stacks or vents occur in outside wall construction, insulation shall be applied between the winter-cold side of the wall and the pipe.

Batts having membrane facing or enveloping membranes shall be installed with the affixed flanged membrane facing toward the winter-heated side of the construction. Additional end flanges shall be formed of the vapor-barrier membrane facing at the ends of batts by cutting or pushing away the insulation material, leaving the facing for attachment to the framing. Flanges shall be nailed or stapled to framing members not more than 6 inches on center. Joints at perimeter of cutouts, end joints between batts in ceiling construction, and tears or ruptures in the membrane facing shall be sealed with vapor-barrier tape.

Batts without membrane facing shall be secured in place between framing members by means of wood nailing strips or an approved adhesive, standard with the insulation materials manufacturer.

Vapor barriers shall be installed after mineral-wool batts have been placed and shall be applied to the winter-heated side of the construction. Vapor-barrier edges shall occur over framing members. Vapor barriers shall be secured by nails or staples. Vapor barrier shall be cut and fit to accommodate piping, conduits, outlet boxes, and other construction penetrating the vapor barrier. Joints at the perimeter of cutouts and tears or ruptures in the vapor-barrier shall be sealed with vapor-barrier tape.

3.6 WALL INSULATION SYSTEM: METAL STUD

Insulation shall be wired or taped to metal studs as recommended by the metal-stud manufacturer.

3.7 INSPECTION AND ACCEPTANCE PROVISIONS

3.7.1 Finished-Building Insulation Requirements

Building insulation work will be rejected for, but not limited to, any of the following deficiencies:

Thermal insulation material not conforming to the type and nominal thickness indicated for the kind of construction

Insulated construction not having small areas between closely spaced framing members fully insulated

Installed thermal-insulation material damaged or wetted by exposure to inclement weather

Installed vapor barriers having tears, breaks, or ruptures that cannot be sealed with vapor-barrier tape or other approved method

Installed blown-in insulation not conforming to the indicated installed weight per square foot.

Prior to final acceptance, the Contractor shall provide construction as-built details and roof warranty information to the Contracting Officer. Construction details shall include, by building area, the material type, amount, and installation method. An illustration or map of the building may serve this purpose. Data shall have a cover letter/sheet clearly marked with the system name, date, and the words "As built insulation/material." Forward as-built and warranty information to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database.

3.7.2 Repair of Defective Work

Defective work shall be removed and replaced, at no expense to the Government, with building insulation materials that meet the requirements of this section.

3.8 TESTS

Test Reports shall be submitted for water-vapor barrier subgrade Covers for resistance to decay and permeance.

-- End of Section --

SECTION 07220

ROOF AND DECK INSULATION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 84 (2003) Surface Burning Characteristics of Building Materials

FM GLOBAL (FM)

FM P7825 (2003) Approval Guide

FM P9513 (2002) Specialist Data Book Set for Roofing Contractors; contains 1-22 (2001), 1-28 (2002), 1-29 (2002), 1-28R/1-29R (1998), 1-30 (2000), 1-31 (2000), 1-32 (2000), 1-33 (2000), 1-34 (2001), 1-49 (2000), 1-52 (2000), 1-54 (2001)

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir (2004) Building Materials Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Wood nailers

SD-03 Product Data

Fasteners; G

Insulation; G

Include minimum thickness of insulation for steel and concrete decks and fastener pattern for insulation on steel decks.

SD-06 Test Reports

Flame spread and smoke developed ratings

Submit in accordance with ASTM E 84.

SD-07 Certificates

Installer qualifications

SD-08 Manufacturer's Instructions

Nails and fasteners

Roof insulation, including field of roof and perimeter attachment requirements.

SD-12 LEED Documentation Submittals per Section 01352.

1. Credit MR 4.1 and 4.2: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products that have recycled content.

a. Include statements indicating cost for each product having recycled content.

2. Credit MR 5.1 and 5.2: List of proposed regionally manufactured materials and regionally extracted, harvested, or recovered materials.

a. Identify each regionally manufactured material, its source, and cost.

b. Identify each regionally extracted, harvested or recovered material, its source, and cost.

1.3 MANUFACTURER'S CERTIFICATE

Submit certificate from the insulation manufacturer attesting that the installer has the proper qualifications for installing tapered roof insulation systems.

Certificate attesting that the expanded perlite or polyisocyanurate insulation contains recovered material and showing estimated percent of recovered material. Certificates of compliance for felt materials.

1.4 QUALITY ASSURANCE

1.4.1 Insulation on Steel Decks

Roof insulation shall have a flame spread rating not greater than 75 and a smoke developed rating not greater than 150, exclusive of covering, when tested in accordance with ASTM E 84. Insulation bearing the UL label and listed in the UL Bld Mat Dir as meeting the flame spread and smoke developed ratings will be accepted in lieu of copies of test reports. Compliance with flame spread and smoke developed ratings will not be required when insulation has been tested as part of a roof construction assembly of the type used for this project and the construction is listed

as fire-classified in the UL Bld Mat Dir or listed as Class I roof deck construction in the FM P7825. Insulation tested as part of a roof construction assembly shall bear UL or FM labels attesting to the ratings specified herein.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

Deliver materials to site in manufacturer's unopened and undamaged standard commercial containers bearing the following legible information:

- a. Name of manufacturer;
- b. Brand designation;
- c. Specification number, type, and class, as applicable, where materials are covered by a referenced specification; and

Deliver materials in sufficient quantity to allow continuity of the work.

1.5.2 Storage and Handling

Store and handle materials in a manner to protect from damage, exposure to open flame or other ignition sources, and from wetting, condensation or moisture absorption. Store in an enclosed building or trailer that provides a dry, adequately ventilated environment. Replace damaged material with new material.

1.6 ENVIRONMENTAL CONDITIONS

Do not install roof insulation during inclement weather or when air temperature is below 40 degrees F and interior humidity is 45 percent or greater, or when there is visible ice, frost, or moisture on the roof deck.

1.7 PROTECTION OF PROPERTY

1.7.1 Protective Coverings

Install protective coverings at paving and building walls adjacent to hoist and kettles prior to starting the work. Lap protective coverings at least 6 inches, secure them against wind, and vent them to prevent collection of moisture on the covered surfaces. Keep protective coverings in place for the duration of the work with asphalt products.

1.7.2 Special Protection

Provide special protection approved by the insulation manufacturer, or avoid heavy traffic on completed work when ambient temperature is above 80 degrees F.

PART 2 PRODUCTS

2.1 THERMAL INSULATION MATERIALS (OR UNDERLAYMENT)

Insulation shall contain recycled content.

Insulation manufacturer shall be located within 500 miles of the project site.

2.1.1 Rigid Insulation Board

Expanded polystyrene (EPS) boards are molded, closed-cell, expanded polystyrene boards. The boards are manufactured at minimum densities of 0.90, 1.15, 1.35 and 1.80 pcf (14.4, 18.4, 21.6, 28.8 kg/m³). The designations for each density are Type I, Type VIII, Type II and Type IX. The products comply with ASTM C 578.

EPS boards with a maximum thickness of 6 inches have a flame-spread index not exceeding 25 and a smoke-development index not exceeding 450 when tested in accordance with ASTM E 84.

2.1.2 Insulation Thickness

As necessary to provide a minimum thermal resistance R value of R-38 or more for average thickness of tapered system. Thickness shall be based on the "R" value for aged insulation. Insulation over steel decks shall satisfy both specified R value and minimum thickness for width of rib opening recommended in insulation manufacturer's published literature.

2.2 SHEATHING PAPER FOR WOOD DECKS

Rosin-sized building paper or unsaturated felt weighing not less than 5 pounds per 100 square feet.

2.3 MOISTURE CONTROL

2.3.1 Vapor Barrier

2.3.1.1 Polyvinylchloride Sheet

Polyvinylchloride sheet vapor barriers shall be unplasticized virgin polyvinylchloride and shall be not less than 0.004 inch thick, with water vapor permeance of not more than 0.10 on a spot-by-spot basis, not as an average. Permeance shall be measured in accordance with ASTM E 96, Water Method.

2.4 FASTENING MATERIALS

2.4.1 Adhesives

2.4.1.1 Insulation or Underlayment

Adhesive for application of insulation or underlayment to steel decks shall be nonflammable and shall meet the requirements of the Underwriters Laboratories, Inc., for a metal roof-deck construction assembly; the Contractor shall submit proof of such conformance. Label of the Underwriters Laboratories, Inc., will be acceptable evidence. In lieu of

the label, the Contractor may submit a written certificate from any approved nationally recognized testing organization adequately equipped and competent to perform such services, stating that the adhesive conforms to the requirements, including methods of testing, of the Underwriters Laboratories, Inc.

2.4.1.2 Polyvinyl-Sheet

Adhesive for application of film polyvinyl-sheet vapor barriers shall be rubber-base water-resistant material with a nontoxic vehicle especially prepared for application of polyvinyl-sheet membrane to roof decks. Holding power of the adhesive shall be not less than 100 psi. Adhesive shall be certified by the manufacturer on the basis of tests by an independent testing laboratory to have a tunnel flame spread of not more than 10 when applied to a noncombustible surface.

2.4.2 Fasteners

Roofing nails shall be galvanized annular or spiral threaded for plywood deck of sufficient length for maximum penetration into deck or wood nailer.

Self-clinching nails shall have a minimum holding capacity of 20 pounds per fastener, when driven.

Insulation holddown clips shall be as recommended by the insulation manufacturer and approved prior to installation.

2.5 WOOD NAILERS

Pressure-preservative-treated as specified in Section 06100N Rough Carpentry.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

3.1.1 Surface Inspection

Surfaces shall be clean, smooth, and dry. Surfaces receiving vapor retarder shall be free of projections which might puncture the vapor retarder. Check roof deck surfaces, including surfaces sloped to roof drains and outlets, for defects before starting work.

The Contractor shall inspect and approve the surfaces immediately before starting installation. Prior to installing vapor retarder and insulation, perform the following:

- a. Examine steel decks to ensure that panels are properly secured to structural members and to each other and that surfaces of top flanges are flat or slightly convex.

3.1.2 Surface Preparation

Correct defects and inaccuracies in roof deck surface to eliminate poor

drainage and hollow or low spots and perform the following:

- a. Install wood nailers the same thickness as insulation at eaves, edges, curbs, walls, and roof openings for securing cant strips, gravel stops, gutters, and flashing flanges. Space nailers in accordance with approved shop drawings.
- b. Fill or cover cracks or knot holes larger than 1/2 inch in diameter in wood decks as necessary to form an unyielding surface.
- c. Cover steel decks with a layer of insulation board of sufficient thickness to span the width of a deck rib opening, and conforming to fire safety requirements. Secure with piercing or self-drilling, self-tapping fasteners of quantity and placement conforming to FM P7825. Insulation joints parallel to ribs of deck shall occur on solid bearing surfaces only, not over open ribs.

3.2 INSTALLATION OF VAPOR RETARDER

Install vapor retarder in direct contact with roof deck surface. Side and end laps shall be completely sealed. At walls, eaves and rakes, and other vertical surfaces, the vapor retarder shall be extended 9 inches. At roof penetrations other than walls, eaves and rakes, and vertical surfaces, the vapor retarder shall be extended 9 inches to form a lap which shall later be folded back over the edge of the insulation.

3.2.1 Vapor Retarder on Steel Decks

3.2.1.1 Polyvinyl-Sheet

Adhesive for application of film polyvinyl-sheet vapor barriers shall be rubber-base water-resistant material with a nontoxic vehicle especially prepared for application of polyvinyl-sheet membrane to roof decks. Holding power of the adhesive shall be not less than 100 psi. Adhesive shall be certified by the manufacturer on the basis of tests by an independent testing laboratory to have a tunnel flame spread of not more than 10 when applied to a noncombustible surface.

3.3 INSULATION INSTALLATION

Apply insulation in two layers with staggered joints when total required thickness of insulation exceeds 1/2 inch. Lay insulation so that continuous longitudinal joints are perpendicular to direction of metal roofing, as specified in Section, and end joints of each course are staggered with those of adjoining courses. When using multiple layers of insulation, joints of each succeeding layer shall be parallel and offset in both directions with respect to layer below. Keep insulation 1/2 inch clear of vertical surfaces penetrating and projecting from roof surface.

3.3.1 Installation Using Only Mechanical Fasteners

Secure total thickness of insulation with penetrating type fasteners.

3.3.2 Special Precautions for Installation of Foam Insulation

3.3.2.1 Polystyrene Insulation

- a. Over top surface of non-composite polystyrene board, install 1/2 inch thick high density wood fiberboard, 3/4 inch thick expanded perlite board, glass mat gypsum roof board, or other overlayment approved by roofing sheet manufacturer. Tightly butt and stagger joints of field applied overlayment board at least 6 inches with respect to the polystyrene board below. Apply 6 inch wide glass fiber roofing tape centered over joints and edges of overlayment board.
- b. Where composite boards consisting of polystyrene insulation are provided, apply 6 inch wide glass-fiber roofing tape centered over joints and edges of composite board. Apply joint strips as recommended by roofing sheet manufacturer.

3.4 PROTECTION

3.4.1 Protection of Applied Insulation

Completely cover each day's installation of insulation with the finished roofing specified on same day. Do not permit phased construction. Protect open spaces between insulation and parapets or other walls and spaces at curbs, scuttles, and expansion joints, until permanent roofing and flashing are applied. Do not permit storing, walking, wheeling, or trucking directly on insulation or on roofed surfaces. Provide smooth, clean board or plank walkways, runways, and platforms near supports, as necessary, to distribute weight to conform to indicated live load limits of roof construction. Exposed edges of the insulation shall be protected by cutoffs at the end of each work day or whenever precipitation is imminent.

3.4.2 Damaged Work and Materials

Restore work and materials that become damaged during construction to original condition or replace with new materials.

3.5 INSPECTION

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed roof insulation with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of insulation workers; start and end time of work.
- b. Verification of certification, listing or label compliance with FM P9513.
- c. Verification of proper storage and handling of insulation and vapor retarder materials before, during, and after installation.

- d. Inspection of vapor retarder application, including edge envelopes and mechanical fastening.
- e. Inspection of mechanical fasteners; type, number, length, and spacing.
- f. Coordination with other materials, cants, sleepers, and nailing strips.
- g. Inspection of insulation joint orientation and laps between layers, joint width and bearing of edges of insulation on deck.
- h. Installation of cutoffs and proper joining of work on subsequent days.
- i. Continuation of complete roofing system installation to cover insulation installed same day.

-- End of Section --

SECTION 07240

EXTERIOR INSULATION AND FINISH SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B 117	(2002) Operating Salt Spray (Fog) Apparatus
ASTM C 150	(2002a ¹) Portland Cement
ASTM C 578	(2003a) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 67	(2003a) Sampling and Testing Brick and Structural Clay Tile
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM D 2247	(2002) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 3273	(2000) Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
ASTM D 968	(1993; R 2001) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E 2098	(2000) Determining Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for Use in Class PB Exterior Insulation and Finish Systems (EIFS) after Exposure to a Sodium Hydroxide Solution
ASTM E 330	(2002) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 331	(2000) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 695	(1979; R 1997e ¹) Measuring Relative

Resistance of Wall, Floor, and Roof
Construction to Impact Loading

ASTM E 84 (2003) Surface Burning Characteristics of
Building Materials

ASTM G 23 (1996) Operating Light-Exposure Apparatus
(Carbon-Arc Type) With and Without Water
for Exposure of Nonmetallic Materials

EIFS INDUSTRY MEMBERS ASSOCIATION (EIMA)

EIMA TM 101.01 (1995) Freeze/Thaw Resistance of Exterior
Insulation and Finish Systems (EIFS),
Class PB

EIMA TM 101.86 (1995) Resistance of Exterior Insulation
Finish Systems (EIFS), Class PB to The
Effects of Rapid Deformation (Impact)

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

UBC 26-4 Evaluation of Flammability Characteristics
of Exterior, Non load-Bearing Wall Panel
Assemblies using Foam Plastic Insulation

UBC 26-9 Evaluation of Flammability Characteristics
of Exterior Non load-Bearing Wall
Assemblies Containing Combustible
Components using Intermediate-Scale,
Multistory Test Apparatus Title

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 268 (2001) Determining Ignitibility of Exterior
Wall Assemblies Using a Radiant Heat
Energy Source

1.2 SYSTEM DESCRIPTION AND REQUIREMENTS

The exterior insulation and finish system (EIFS) shall be a job-fabricated exterior wall covering consisting of sheathing, insulation board, reinforcing fabric, base coat, finish coat, adhesive and mechanically fasten. The system components shall be compatible with each other and with the substrate as recommended or approved by, and the products of, a single manufacturer regularly engaged in furnishing Exterior Insulation and Finish Systems. All materials shall be installed by an applicator approved by the system manufacturer. EIFS shall be Class PB.

1.2.1 System Requirements and Tests

The system shall meet the performance requirements as verified by the tests

listed below. Where a wall system of similar type, size, and design as specified for this project has been previously tested under the condition specified herein, the resulting test reports may be submitted in lieu of job specific tests.

1.2.1.1 Water Penetration

Test the system for water penetration by uniform static air pressure in accordance with ASTM E 331. There shall be no penetration of water beyond the plane of the base coat/EPS board interface after 15 minutes at 6.4 psf), or 20% of positive design wind pressure, whichever is greater.

1.2.1.2 Wind Load

Test the system for wind load by uniform static air pressure in accordance with ASTM E 330 (procedure A) to a minimum pressure of 25 psf. There shall be no permanent deformation, delamination, or other deterioration.

1.2.1.3 Full scale or intermediate scale fire test

Conduct wall fire test using apparatus, specimen, performance criteria, and procedure in accordance with UBC 26-4. The specimen shall include the complete system using 4 inch thick insulation board. At the option of the contractor, UBC 26-9, Intermediate-Scale Test may be substituted in lieu of the Full-Scale Multi- Story Fire test. The following requirements shall be met:

- a. No vertical spread of flame within core of panel from one story to the next.
- b. No flame spread over the exterior surface.
- c. No vertical flame spread over the interior surface from one story to the next.
- d. No significant lateral spread of flame from compartment of fire origin to adjacent spaces.

1.2.1.4 Mock-Up Installation of EIFS

Complete wall mock-up installation 8 ft high by 8 ft wide, including typical control joints and at least one window opening. Control joints to be filled with sealant of type, manufacturer, and color selected. Construct mock-up installation at job site. Build mock-up to comply with the following requirements, using materials indicated for the completed work:

- a. Locate mock-up installation(s) in the location and size as directed by the Contracting officer.
- b. Demonstrate the proposed range of color, texture, thickness, insulation, and workmanship.
- c. Obtain Contracting Officer's written approval of mock-up before starting fabrication of work.

d. Maintain mock-up installation(s) during construction as a standard for judging the completed work by protecting them from weather and construction activities.

e. When directed, demolish and remove mock-up from the site.

1.2.2 Component Requirements and Tests

The components of the system shall meet the performance requirements as verified by the tests listed below.

1.2.2.1 Surface Burning Characteristics

Conduct ASTM E 84 test on samples consisting of insulation board, base coat, reinforcing fabric, and finish coat. Cure for 28 days. The flame spread index shall be 25 or less and the smoke developed index shall be 450 or less.

1.2.2.2 Radiant Heat

The system shall be tested in accordance with NFPA 268 with no ignition during the 20-minute period.

1.2.2.3 Impact Resistance

a. Class PB Systems: Hemispherical Head Test; 28 day cured specimen of PB EIFS in accordance with EIMA TM 101.86. The test specimen shall exhibit no broken reinforcing fabric per EIMA TM 101.86 at an impact of 25-49 in/lb.

b. Impact Mass: Test 28 day cured specimen of PM EIFS in accordance with ASTM E 695. The test specimen shall exhibit no cracking or denting after twelve impacts by 30 lbs lead shot mass from 6 in to 6 ft drop heights in 6 in intervals.

1.2.3 Sub-Component Requirements and Tests

Unless otherwise stated, the test specimen shall consist of reinforcement, base coat, and finish coat applied in accordance with manufacturer's printed recommendations to the insulation board to be used on the building.

For mildew resistance, only the finish coat is applied onto glass slides for testing. These specimen shall be suitably sized for the apparatus used and be allowed to cure for a minimum of 28 days prior to testing.

1.2.3.1 Abrasion Resistance

Test in accordance with ASTM D 968, Method A. Test a minimum of two specimen. After testing, the specimens shall show only very slight smoothing, with no loss of film integrity after 132 gallons of sand.

1.2.3.2 Accelerated Weathering

Test in accordance with ASTM G 23, Method 1. After 2000 hours specimens shall exhibit no visible cracking, flaking, peeling, blistering, yellowing, fading, or other such deterioration.

1.2.3.3 Mildew Resistance

Test in accordance with ASTM D 3273. The specimen shall consist of the finish coat material, applied to clean 3 inch by 4 inch glass slides and shall be allowed to cure for 28 days. After 28 days of exposure, the specimen shall not show any growth.

1.2.3.4 Salt Spray Resistance

Test in accordance with ASTM B 117. The specimen shall be a minimum of 4 inch by 6 inch and shall be tested for 300 hours. After exposure, the specimen shall exhibit no observable deterioration, such as chalking, fading, or rust staining.

1.2.3.5 Water Resistance

Test in accordance with ASTM D 2247. The specimen shall be a minimum of 4 inch by 6 inch. After 14 days, the specimen shall exhibit no cracking, checking, crazing, erosion, blistering, peeling, or delamination.

1.2.3.6 Absorption-Freeze/Thaw

Class PB systems shall be tested in accordance with EIMA TM 101.01 for 60 cycles of freezing and thawing. No cracking, checking, or splitting, and negligible weight gain. Class PM systems shall be tested in accordance with ASTM C 67 for 50 cycles of freezing and thawing. After testing, the specimens shall exhibit no cracking or checking, and have negligible weight gain.

1.2.3.7 Sample Boards

Unless otherwise stated, provide sample EIFS Component (12 by 24 inches), on sheathing board, including finish color and texture, typical joints and sealant. If more than one color, finish, or pattern is used, provide one sample for each. The test specimen shall consist of reinforcement, base coat, and finish coat applied in accordance with manufacturer's printed recommendations to the insulation board to be used on the building.

1.2.4 Moisture Analysis

Perform a job specific vapor transmission analysis based on project specific climate and specified wall components and materials. Indicate the temperatures and relative humidities for the inside and outside of the building; a complete listing of the building components, their thickness, thermal resistance and permeance, as well as building location and use. If a mathematical model was used for the analysis, include the name of the model and the supplier/developer.

1.3 SUBMITTALS

Hi-lite all descriptive literature to accomplish identification of specific components/items which are proposed to be furnished. Government will not react to descriptive material/literature which has not been hi-lited, except to reject the Submittal.

SD-02 Shop Drawings: Show fabrication and installation of system including plans, elevations, sections, details of components, joint locations and configurations within system and between system and construction penetrating it, termination details, and attachments to construction behind system.

Samples for Initial Selection: Manufacturer's color charts and small-scale samples consisting of units or sections of units showing the full range of colors, textures, and patterns available for each finish choice indicated.

Submit sealant manufacturer's standard bead samples consisting of strips of actual products showing the full range of colors available.

SD-02 Shop Drawings

Shop drawings; G

Show wall layout, construction and expansion joints, decorative grooves, layout of sheathing board, thermal insulation board, and reinforcement mesh and strip reinforcing fabric; joint and flashing details; details at wall penetrations; types and location of fasteners; details at windows and doors; and details at base, roof, and corners.

SD-03 Product Data: For each component of EIFS specified.

SD-03 Product Data

Sheathing board

Thermal insulation

Adhesive

Mechanical Fasteners

Accessories

Base coat

Portland cement

Reinforcing fabric

Finish coat

Joint Sealant

Primer

Bond breaker

Backer Rod

Insulation Board

Warranty

Include joint and other details, such as end conditions, corners, windows, parapet. Include shelf life and recommended cleaning solvents in data for sealants. Include material safety data sheets (MSDS) for all components of the EIFS. The MSDS shall be available at the job site.

SD-04 Samples

Sample Boards; G

Color and Texture

Mock-up Installation of EIFS; G

SD-05 Design Data

Wind load Calculations

Moisture analysis Calculations

SD-06 Test Reports

Abrasion resistance

Accelerated weathering

Impact resistance

Mildew resistance

Salt spray resistance

Water vapor transmission

Absorption-freeze-thaw

Wall fire test

Water penetration

Water resistance

Full scale or intermediate scale fire test

Surface Burning Characteristics

Radiant heat

substrate

Wind load

SD-07 Certificates

Qualifications of EIFS Manufacturer

Qualification of EIFS Installer

Qualification of Sealant Applicator

Certify that EIFS installer meets requirements specified under paragraph "Qualification of Installer," and that sealant applicator is approved by the EIFS Manufacturer.

Qualifications of Third Party Inspector

Inspection Check List; G

Submit filled-out inspection check list as required in paragraph "Quality Control," certifying that the installation of critical items meets the requirements of this specification.

SD-08 Manufacturer's Instructions

Installation

Manufacturer's standard printed instructions for the installation of the EIFS. Include requirements for condition and preparation of substrate, installation of EIFS, and requirements for sealants and sealing.

SD-10 Operation and Maintenance Data

EIFS

Include detailed finish repair procedures and information regarding compatibility of sealants with base and finish coatings.

SD-12 LEED Submittals per Section 01352

1. Credit MR 4.1 and 4.2: Product data indicating percentages by weight of post-consumer and post-industrial recycled products for products having recycled content.
 - a. Include statements indicating cost for each product having recycled content, minus labor, equipment, and profit.
2. Credit MR 5.1 and 5.2: Submit invoices and documentation indicating manufacturing location for all materials manufactured within 500 miles of project site.
 - a. Include statements indicating location of extraction, harvest, or recovery of product components within 500 miles of the site.

- b. Include statements indicating costs for products manufactured within 500 miles of the project site.

1.4 QUALITY ASSURANCE

1.4.1 Qualifications of EIFS Manufacturer

The EIFS shall be the product of a manufacturer who has been in the practice of manufacturing and designing EIFS for a period of not less than 3 years, and has been involved in at least five projects similar to this project in size, scope, and complexity, in the same or a similar climate as this project.

1.4.2 Qualification of EIFS Installer

The EIFS Installer shall be trained and approved by the EIFS manufacturer to install the system and shall have successfully installed at least five projects at or near the size and complexity of this project. The contractor shall employ qualified workers trained and experienced in installing the manufacturer's EIFS.

1.4.3 Qualification of Sealant Applicator

The sealant applicator shall be experienced and competent in the installation of high performance industrial and commercial sealants and shall have successfully installed at least five projects at or near the size and complexity of this project.

1.4.4 Qualifications of Third Party Inspector

Submit evidence that third party inspector has current certification from the Exterior Design Institute or equal inspector certification as inspector for the installation of EIFS.

1.4.5 Insulation Board

Insulation Board shall be approved and labeled under third party quality program as required by applicable building code.

1.4.6 Pre-Installation Conference

After approval of submittals and before commencing any work on the EIFS, including installation of any insulation and associated work, the Contracting Officer will hold a pre-installation conference to review:

- a. Drawings, specifications, and samples;
- b. Procedure for on site inspection and acceptance of EIFS substrate and pertinent details (for example, mock-up installation);
- c. Contractor's plan for coordination of work of the various trades involved in providing EIF system and other components;

- d. Inspection procedures; and
- e. Safety requirements.

Pre-installation conference shall be attended by the Contractor, EIFS Q.C.

Specialist and all personnel directly responsible for installation of the EIF system, including sealant applicator, and personnel responsible for related work, such as flashing and sheet metal, windows and doors, and a representative of the EIFS manufacturer. Before beginning EIFS work, the contractor shall confirm in writing the resolution of conflicts among those attending the preinstallation conference.

1.5 DELIVERY AND STORAGE

Deliver materials to job site in original unopened packages, marked with manufacturer's name, brand name, and description of contents. Store materials off the ground and in accordance with the manufacturer's recommendations in a clean, dry, well-ventilated area. Protect stored materials from rain, sunlight, and excessive heat. Keep coating materials which would be damaged by freezing at a temperature not less than 40 degrees F. Do not expose insulation board to flame or other ignition sources.

1.6 ENVIRONMENTAL CONDITIONS

- a. Do not prepare materials or apply EIFS during inclement weather unless appropriate protection is provided. Protect installed materials from inclement weather until they are dry.
- b. Apply sealants and wet materials only at ambient temperatures of 40 degrees F or above and rising, unless supplemental heat is provided. The system shall be protected from inclement weather and to maintain this temperature for a minimum of 24 hours after installation.
- c. Do not leave insulation board exposed to sunlight after installation.

1.7 WARRANTY

Furnish manufacturer's standard warranty for the EIFS. Warranty shall run directly to Government and cover a period of not less than 5 years from date Government accepted the work.

PART 2 PRODUCTS

2.1 COMPATIBILITY

Provide all materials compatible with each other and with the substrate, and as recommended by EIFS manufacturer.

2.2 ADHESIVE

Manufacturer's standard product, including primer as required, and shall be

compatible with substrate and insulation board to which the system is applied.

2.3 MECHANICAL FASTENERS

Corrosion resistant and as approved by EIFS manufacturer. Select fastener type and pattern based on applicable wind loads and substrate into which fastener will be attached, to provide the necessary pull-out, tensile, and shear strengths.

2.4 THERMAL INSULATION

2.4.1 Manufacturer's Recommendations

Provide only thermal insulation as required by LEED, per this Specification for the type of application intended.

2.4.2 Insulation Board

Insulation board shall be EPS (Expanded Polystyrene Insulation) and shall be compatible with other systems components. Boards shall be factory marked individually with the manufacturer's name or trade mark, the material specification number, the R-value at (75 degree F), and thickness.

No layer of insulation shall be less than (3/4 in) thick. The maximum thickness of all layers shall not exceed (4 in). Insulation Board shall be certified as aged, in block form, prior to cutting and shipping, a minimum of 6 weeks by air drying, or equivalent.

- a. Thermal resistance: As indicated
- b. Insulating material: ASTM C 578 Type I or IV, as recommended by the EIFS manufacturer and treated to be compatible with other EIFS components. Age insulation by air drying a minimum of 6 weeks prior to cutting and shipping.

2.5 BASE COAT

Manufacturer's standard product and compatible with other systems components.

2.6 PORTLAND CEMENT

Conform to ASTM C 150, Type I or II as required, fresh and free of lumps, and approved by the systems manufacturer.

2.7 REINFORCING FABRIC

Reinforcing fabric mesh shall be alkali-resistant, balanced, open weave, glass fiber fabric made from twisted multi-end strands specifically treated for compatibility with the other system materials, and comply with ASTM E 2098 and as recommended by EIFS manufacturer.

2.8 FINISH COAT

Manufacturer's standard product conforming to the requirements in the paragraph on Sub-Component Requirements and Tests. For color consistency, use materials from the same batch or lot number.

2.9 PRIMER

Non-staining, quick-drying type recommended by sealant manufacturer and EIFS manufacturer.

2.10 ACCESSORIES

Conform to recommendations of EIFS manufacturer, including trim, edging, anchors, expansion joints. All metal items and fasteners to be corrosion resistant.

2.11 JOINT SEALANT

Non-staining, quick-drying type meeting ASTM C 920, Class 25, compatible with the finish system type and grade, and recommended by both the sealant manufacturer and EIFS manufacturer.

2.12 BOND BREAKER

As required by EIFS manufacturer and recommended by sealant manufacturer and EIFS manufacturer.

2.13 BACKER ROD

Closed cell polyethylene free from oil or other staining elements and as recommended by sealant manufacturer and EIFS manufacturer. Do not use absorptive materials as backer rod. The backer rod should be sized 25 percent larger than the width of the joint.

PART 3 EXECUTION

3.1 EXAMINATION

Examine substrate and existing conditions to determine that the EIFS can be installed as required by the EIFS manufacturer and that all work related to the EIFS is properly coordinated. Surface shall be sound and free of oil, loose materials or protrusions which will interfere with the system installation. If deficiencies are found, notify the Contracting Officer and do not proceed with installation until the deficiencies are corrected. The substrate shall be plane, with no deviation greater than (1/4 inch) when tested with a (10 foot) straightedge. Determine flatness, plumbness, and any other conditions for conformance to manufacturer's instructions.

3.2 SURFACE PREPARATION

Prepare existing surfaces for application of the EIFS to meet flatness tolerances and surface preparation according to manufacturer's installation instructions [but provide a flatness of not more than 1/4 inch in 10 feet]. Provide clean surfaces free of oil and loose material without protrusions adversely affecting the installation of the insulation board. For

adhesively attached EIFS, existing deteriorated paint must be removed. Due to substrate conditions or as recommended by the system manufacturer, a primer may be required. Apply the primer to existing surfaces as recommended by the manufacturer. Use masking tape to protect areas adjacent to the EIFS to prevent base or finish coat to be applied to areas not intended to be covered with the EIFS. The contractor shall not proceed with the installation until all noted deficiencies of the substrate are corrected.

3.3 INSTALLATION

Install EIFS as indicated, comply with manufacturer's instructions except as otherwise specified, and in accordance with the shop drawings. EIFS shall be installed only by an applicator trained and approved by the EIFS manufacturer. Specifically, include all manufacturer recommended provisions regarding flashing and treatment of wall penetrations.

3.3.1 Sheathing Board

Edges and ends of boards shall be butted snugly with vertical joints staggered to provide full and even support for the insulation. Do not align sheathing board joints with wall openings. Provide support at both vertical and horizontal joints. Attach sheathing board to metal studs with self-tapping drywall screws. Place fasteners sufficiently close to support imposed loads, but not more than:

- a. (8 inches) apart on each supporting stud

Space fasteners more closely when required for negative wind load resistance.

3.3.2 Insulation Board

Unless otherwise specified by the system manufacturer, place the long edge horizontally from level base line. Stagger vertical joints and interlock at corners. Butt joints tightly. Provide flush surfaces at joints. Offset insulation board joints from joints in sheathing by at least (8 inches). Use L-shaped insulation board pieces at corners of openings. Joints of insulation shall be butted tightly. Surfaces of adjacent insulation boards shall be flush at joints. Gaps greater than (1/16 inch) between the insulation boards shall be filled with slivers of insulation. Uneven board surfaces with irregularities projecting more than (1/16 inch) shall be rasped in accordance with the manufacturer's instructions to produce an even surface. Attach insulation board as recommended by manufacturer. The adhered insulation board shall be allowed to remain undisturbed for 24 hours prior to proceeding with the installation of the base coat/reinforcing mesh, or longer if necessary for the adhesive to dry.

However, do not leave insulation board exposed longer than recommended by insulation manufacturer.

3.3.2.1 Mechanically and Adhesively Fastened Insulation Boards

First apply insulation board using adhesive spread with a notched trowel to the back of the insulation boards in accordance with the manufacturer's

instructions.

Then apply manufacturer's standard corrosion resistant anchors, spaced as recommended by manufacturer, but not more than (2 feet) horizontally and vertically. After adhesively applying insulation.

3.3.3 Base Coat and Reinforcing Fabric Mesh

3.3.3.1 Class PB Systems

Mix base coat in accordance with the manufacturer's instructions and apply to insulated wall surfaces to the thickness specified by the system manufacturer and provide any other reinforcement recommended by EIFS manufacturer. Trowel the reinforcing fabric mesh into the wet base coat material. Fully embed the mesh in the base coat. When properly worked-in, the pattern of the reinforcing fabric mesh shall not be visible. Provide diagonal reinforcement at opening corners. Back-wrap all terminations of the EIFS. Overlap the reinforcing fabric mesh a minimum of (2 inches) on previously installed mesh, or butted, in accordance with the manufacturer's instructions. Allow the adhered insulation board to dry for 24 hours, or longer if necessary, prior to proceeding with the installation of the base coat/reinforcing fabric mesh. Install reinforcing fabric in accordance with and manufacturer's instructions.

3.3.4 Finish Coat

Apply and level finish coat in one operation. Obtain final texture by trowels, floats, or by spray application as necessary to achieve the required finish matching approved mock-up installation. Apply the finish coat to the dry base coat maintaining a wet edge at all times to obtain a uniform appearance. The thickness of the finish coat shall be in accordance with the system manufacturer's current published instructions. Apply finish coat so that it does not cover surfaces to which joint sealants are to be applied. The base coat/reinforcing mesh must be allowed to dry a minimum of 24 hours prior to the application of the finish coat. Surface irregularities in the base coat, such as trowel marks, board lines, reinforcing mesh laps, etc., shall be corrected prior to application of the finish coat.

3.4 JOINT SEALING

Seal EIFS at openings as recommended by the system manufacturer. Apply sealant only to the base coat. Do not apply sealant to the finish coat.

3.4.1 Surface Preparation, Backer Rod, and Primer

Immediately prior to application, remove loose matter from joint. Ensure that joint is dry and free of paint, finish coat, or other foreign matter. Install backer rod. Apply primer as required by sealant and EIFS manufacturer. Check that joint width is as shown on drawings but in no case shall it be less than (0.5) inch for perimeter seals and (0.75 inch) for expansion joints. The width shall not be less than 4 times the anticipated movement. Check sealant manufacturer's recommendations regarding proper width to depth ratio.

3.4.2 Sealant

Apply sealant in accordance with sealant manufacturer's instructions with gun having nozzle that fits joint width. Do not use sealant that has exceeded shelf life or can not be discharged in a continuous flow. Completely fill the joint solidly with sealant without air pockets so that full contact is made with both sides of the joint. Tool sealant with a round instrument that provides a concave profile and a uniformly smooth and wrinkle free sealant surface. Do not wet tool the joint with soap, water, or any other liquid tooling aid. Do not apply sealant until all EIFS coatings are fully dry. During inclement weather, protect the joints until sealant application. Use particular caution in sealing joints between window and door frames and the EIFS wall and at all other wall penetrations. Clean all surfaces to remove excess sealant.

3.5 FIELD QUALITY CONTROL

Throughout the installation, the contractor shall establish and maintain an inspection procedure to assure compliance of the installed EIFS with contract requirements. Work not in compliance shall be removed and replaced or corrected in an approved manner. The inspection procedures, from acceptance of deliveries through installation of sealants and final acceptance shall be performed by qualified inspector trained by the manufacturer. No work on the EIFS shall be performed unless the inspector is present at the job site.

3.5.1 Third Party Inspection

Provide full time third party inspection during the entire process of installing the EIFS, from examination through cleanup. The third party inspector shall be certified by the Exterior Design Institute (EDI) or by an equivalent independent party and shall be trained in the proper installation of EIFS.

3.5.2 Inspection Check List

During the installation and at the completion of installation, perform inspections covering at the minimum all applicable items enumerated on the attached check list. The inspector shall initial and date all applicable items, sign the check list, and submit it to the Contracting Officer at the completion of the EIFS erection.

CHECK LIST

<u>Item</u>	<u>Description</u>	<u>Appr'd/Date</u>
a.	Materials are handled and stored correctly.	_____
b.	Environmental conditions are within specified limits, including temperature not below 4 degrees C (40 degrees F), and the work is protected from the elements as required.	_____

CHECK LIST

<u>Item</u>	<u>Description</u>	<u>Appr'd/Date</u>
c.	Preparation and installation is performed by qualified personnel using the correct tools.	=====
d.	Adjacent areas to which EIFS is not to be applied (such as on window and door frames) are protected with masking tape, plastic films, drop cloths, etc. to prevent accidental application of EIFS materials.	=====
e.	Control, expansion and aesthetic joints are installed as indicated or recommended. Accessories are properly installed.	=====
f.	Substrate is in-plane, properly attached, clean, dry, and free of contaminants. Concrete substrate is free of efflorescence.	=====
g.	Materials are mixed thoroughly and in proper proportions.	=====
h.	Adhesive is applied in sufficient quantity with proper-size notched trowel.	=====
i.	Mechanical attachments have proper spacing, layout and fastener depth.	=====
j.	Insulation boards are tightly abutted, in running bond pattern, with joints staggered with the sheathing, board corners interlocked, L-shaped boards around openings, edges free of adhesive, and provision for joints. Gaps are filled and surfaces rasped.	=====
k.	Insulation adhesive must be allowed to dry (a minimum of 24-hours) prior to the application of the finish coat.	=====
l.	Reinforcing fabric mesh is properly back-wrapped at terminations.	=====
m.	Reinforcing fabric mesh is fully embedded and properly placed. Corners are reinforced. Openings are diagonally reinforced. Mesh overlaps minimum 65 mm (2-1/2 inches).	=====
n.	Base coat thickness is within specified limits.	=====
o.	The base coat/reinforcing fabric mesh must be allowed to dry (a minimum of 24-hours) prior to the application of the finish coat.	=====
p.	Finish coat is applied with sufficient number of personnel and stopped at suitable points. Floats and	=====

CHECK LIST

<u>Item</u>	<u>Description</u>	<u>Appr'd/Date</u>
	methods of texturing are uniform.	
q.	All Flashings are properly installed.	=====
r.	All joints are properly sealed in their entire length at time and under environmental conditions as specified by the manufacturer.	=====
s.	All scaffolding, equipment, materials, debris and temporary protection are removed from site upon completion.	=====
Name of Inspector:_____ Signed:_____ Date:_____		

3.6 CLEANUP

Upon completion, remove all scaffolding, equipment, materials and debris from site. Remove all temporary protection installed to facilitate installation of EIFS.

-- End of Section --

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SECTION 07410

STANDING SEAM METAL ROOFING (SSMR)

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.2 DESCRIPTION OF WORK

1.3.1 Furnish the administration, facilities, materials, labor, equipment, and quality control (QC) necessary to integrate the work into the total building system so that leakage of the standing seam metal roofing (SSMR) system or the building does not occur. The SSMR system is an assembly of components that include the metal roof panels, supporting structure, metal flashings, shaped metal trim, metal ridge caps, fascia panels, fascia support structure, soffits, soffit support structure, and all related parts necessary to complete the assembly. The SSMR manufacturer is the metal roof panel manufacturer, and shall also manufacture and market the other components of the roofing system. The manufacturer, or his licensed/approved installer, shall complete the work and provide a material and labor warranty for a twenty-year period from the date of final acceptance of the building. The 20-year warranty submitted to the Government (Submittal #4) shall be signed by the SSMR manufacturer and provided to the Contracting Officer prior to final acceptance.

1.3.2 QC procedures, tolerances, testing, and requirements are specified in these Contract Documents. Nonconforming work will be rejected as a violation of these Specifications.

1.3.3 The work to be performed under this section shall include, but is not limited to, the following:

1.3.3.1 Furnish all qualified supervision, experienced labor, materials, tools, and equipment required or necessary to complete in an acceptable manner the specified SSMR system in accordance with this Specification with the application in strict accordance with the latest written "Contractor Application Instructions" as supplied by the manufacturer.

1.3.3.2 Furnish materials and labor as specified in other sections of these Specifications which directly relate to this Section.

1.3 QUALITY ASSURANCE (QA)

1.4.1 As specified herein, provide the QA evidence needed to establish confidence that quality control (QC) is being performed adequately.

1.4.2 Except as modified and supplemented herein, follow the published requirements and written recommendations of the SSMR manufacturer and other material manufacturers. Concerning methods of installation, industry

practices apply only when this Contract does not address the matter.

1.4.3 The specified QA requirements are minimums. The Contractor shall provide additional QC if, in the opinion of the Contracting Officer, the QC is not effective enough to provide conforming work. This additional QC does not constitute a change to the Contract.

1.4.4 The QC is subject to audit by a Government inspector and the Contractor shall provide all information necessary for the audit.

1.4.4.1 The Government is not obligated to inspect a Contractor's work nor to protect a Contractor from the consequences of malperformance of his/her work force. Government inspection is a general examination of the Contractor's conduct and work, and is solely for the purposes of the Government. Government inspectors does not have the authority to accept any work, whether it be conforming or not. Government inspection is not to be construed as conclusive. Information that may be offered to the Contractor does not change the Contract.

1.4.4.2 Government agents, including inspectors, engineers, and quality assurance evaluators, are not authorized to change the Contract without the written authorization of the Contracting Officer. This lack of authority extends to all situations in which the actions of these agents could be construed as constituting a change.

1.4.5 Provide Quality Control (QC) as follows:

1.4.5.1 Quality Control is the regulatory process by which the Contractor measures actual quality performance, compares it with standards, and acts on the differences. The QC function is the entire collection of activities through which fitness for use is achieved.

1.4.5.2 Contractor inspection is a careful and critical investigation of all work to verify that it conforms to the Contract, and to detect variances and act to correct them in time to prevent reworking and delay. On discovery of variance, the Contractor will immediately institute corrective action and ensure all future work conforms to the requirements of the Contract.

1.4.5.3 The Contractor shall hire or appoint a representative to act as Quality Controller. The quality controller is to have at least five (5) years experience in the supervision and installation of standing seam metal roofing systems, and his/her only function shall be QC.

1.4.5.4 Before the start of roofing work, the Contracting Officer will schedule a preconstruction conference at Malmstrom Air Force Base to review the Contract. The Quality Controller and foreman or superintendent must attend the conference. Technical representative from the SSMR manufacturer and manufacturers of other roofing products shall also attend the preconstruction conference. These representatives shall be knowledgeable in the installation peculiarities and compatibility of their products. Contractor and technical representatives will present oral and documented installation

procedures to be used. This conference may include a visit to the work site.

1.4.5.5 Basic QC requirements appear in Part 4 of these Specifications. As a minimum, the Quality Controller shall perform each of the actions listed on a daily basis. Failure to perform these actions constitutes failure to perform and entitles the Government to terminate the Contractor for default.

1.4 SUBMITTALS

1.5.1 Submit requests for all changes in writing. Do not proceed with any changes without written authorization from the Contracting Officer. In addition, all proposed deviations from the Contract shall be noted on the transmittal, AF Form 3000. If these conditions are not met, the Submittal shall be returned to the Contractor for corrective action. The adequacy and accuracy of Submittals and their compliance with Contract Documents are the responsibility of the Contractor.

1.5.2 Approvals of submittals which do not conform to the Contract shall not be construed as a change unless such nonconformance is a change that is specifically so indicated on the submittal and approved by the Contracting Officer.

1.5.3 Approvals of alternate type SSMR components shall not relieve the Contractor from providing the added requirements specified herein unless those requirements are specifically exempted on the submittal approval form and the exempted requirements are approved or recommended in writing by the manufacturer.

1.5.4 Submittals 1 through 6 are included at the end of this Specification and additional submittal forms shall be obtained from the Contracting Officer.

1.5.4.1 Submittal #1: The SSMR System Manufacturer's Certification. This submittal is a qualification for award of this Contract. It must be submitted as part of the bid, or executed prior to Contract Award, and be accepted by the Contracting Officer.

1.5.4.2 Submittal #2: System Summary Sheet. This must be signed by both the prospective Contractor and the SSMR manufacturer, and submitted to the Contracting Officer prior to Contract Award. This document is tailored to present project requirements to the system manufacturer who can then ascertain the technical aspects of the project and the acceptability of the design to their 20-year warranty.

1.5.4.3 Submittal #3: Designation of Roofing Quality Control Controller. The most effective means to evaluate quality installation is by thorough, continuous visual examination at the time of installation, conducted by a person who is knowledgeable in roofing technology and good workmanship practices. The Contractor shall designate a person to be in charge of roofing quality control. The quality controller shall have at least five (5) years experience in the supervision and inspection of SSMR systems and shall not be a principal

or officer of the roofing Contractor's company. The Air Force inspector will audit the quality control process on a daily basis. The Contractor must furnish Submittal #3 as required herein, modified as necessary, to identify the person in charge of roofing quality control.

This submittal must be approved by the Contracting Officer before the Notice to Proceed (NTP) is issued.

1.5.4.4 Submittal #4: The Air Force Standing Steam Metal Roofing System 20-Year Labor and Material Warranty. The manufacturer shall provide an executed copy of the 20-year warranty (Attachment #4) upon satisfactory completion of the roofing system. The warranty is to be provided to the Contracting Officer prior to final acceptance of the Project.

1.5.4.5 Submittal #5: Sample Identification. Use Attachment #4 for this submittal.

1.5.4.6 Submittal #6: As-Built Roof Summary. The Contractor shall submit this summary upon completion of the project.

1.5.5 Materials Approval: Within ten (10) days after award of Contract, the Contractor shall submit, to the Contracting Officer, certifications from the systems manufacturers/suppliers that the materials to be used conform to specified standards as applicable to produce the SSMR manufacturer's 20-year warranted system.

1.5.6 Within ten (10) days after issuance of Notice to Proceed and before start of work, the Contractor shall submit:

1.5.6.1 Evidence that the approved materials have been ordered.

1.5.6.2 Four (4) copies of:

1.5.6.2.1 Latest editions of the SSMR manufacturer's published general requirements, technical literature, repair instructions, and material safety data sheets (MSDS) for each system to be used in this Contract.

1.5.6.2.2 Shop Drawings for approval prior to starting construction. Shop Drawings shall also be approved by the manufacturer and include the following:

Outline of each roof area and roof area size.
Locations and types of all penetrations, vents, and curbs.
Recommended layout of metal panel sheets.
Recommended flashing system details.
Recommended support structure layout and details.
Recommended support structure-to-roof deck connection details.

1.5.6.2.3 Shop Drawings which address any and all changes in roof details shown on the Contract Drawings.

1.5.6.2.4 Latest editions of all other material manufacturer's product and installation literature.

1.5.7 Panel Lots and Samples: Factory certified test certificates for each lot of metal roofing panels installed shall be furnished along with two (2) samples, 12" long, on receipt at the job site. For this purpose, a "lot" shall be considered one shift (6 or 8 hours) of production. Production harts will be retained for two (2) years for each lot produced and shall be made available for inspection in the event of panel failure. Internal laboratory test records for specific gravity, tensile strength, elongation, and theology shall be retained for each lot for a two (2) year period and shall be made available for inspection in the event of panel failure.

1.5.8 Submit a daily QC Record, AF Form 1063. Obtain blank forms from 341st Civil Engineer Squadron, Engineering Flight.

1.5.9 Before final acceptance, submit:

1.5.9.1 A plan view Drawing of each roof showing the location and dates of installation for each lot of metal roof panels, as identified by the manufacturer's lot number.

1.5.9.2 20-Year Warranty Certification (Submittal #4). The Contractor shall be responsible for notifying the manufacturer of the roofing schedule and arranging for a representative to be on site as required by the warranty.

1.5.9.3 As-Built Roof Summary (Submittal #6).

1.5.10 Before start of work, the Contractor shall submit, for approval, samples of all other roof system components to be used in the construction.

These components include, but are not limited to: flashing, trim, closures, ridge caps, fasteners, two-piece concealed panel clips, gaskets, sealants, roof vent extensions, and weatherheads.

1.5.11 SD-12 LEED Requirements per Section 01352.

1. Credits MR 4.1 and 4.2: Manufacturer's product data indicating percentages by weight of post consumer and post industrial recycled products for all products having recycled content.

a. Include statements indicating cost for each product having recycled content, excluding labor, equipment, and profit.

2. Credit MR 5.1 and 5.2: Submit invoices and documentation indicating manufacturing locations for all materials manufactured within 500 miles of project site.

a. Include statements indicating location of extraction, harvest, or recovery of product components within 500 miles of the project site.

b. Include statements indicating costs for products manufactured within 500 miles of the project site.

1.5 ACCEPTANCE OF COMPLETED WORK

1.6.1 Acceptance of completed work will be based on its conformance to this Contract. Nonconforming work may be rejected; the Government is not

obligated to accept nonconforming work at a reduced price. The Government will assign the roof areas to the Contractor as they are specifically cleared for Contractor access by the Contracting Officer. The Contractor will be prohibited from starting work in a new area until previous work conforms to Specification requirements. Unacceptable work shall be reaccomplished within tolerances prior to the Contractor continuing work in the assigned area. The Contractor shall start replacement or correction of rejected work within ten (10) calendar days after receipt of the rejection notice; otherwise, the Government may have this work done by others and charge the cost to the Contractor. An inadequate QC program is considered nonconforming work.

1.6.2 A signed final acceptance certificate by the Contracting Officer issued to the Contractor is the only and final acceptance under the Inspection of Construction clause of this Contract.

1.6 DELIVERY, STORAGE AND HANDLING

1.7.1 Deliver panels and other components so that they will not be damaged or deformed. Package roof panels for protection against transportation damage.

1.7.2 Exercise care in unloading, storing, and erecting roof panels to prevent bending, warping, twisting, and surface damage.

1.7.3 Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store metal roof panels so that they will not accumulate water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

1.7 SYSTEM PERFORMANCE REQUIREMENTS

1.8.1 Metal Roofing/Fascia Panels:

1.8.1.1 12 inch minimum and 24 inch maximum panel width from seam to seam.

1.8.1.2 0.023 inch minimum bare metal thickness.

1.8.1.3 2 inch minimum rib height; the rib height shall be determined by measuring the vertical distance between the base of the flat portion (the pan) of the panel and the top of the rib (or seam) in the installed panel configuration.

1.8.2 Fasteners: The fasteners listed below shall be the required minimum strength for the connecting condition described. If fastener types other than those listed below are used, they shall be shown by tests to be equal in holding strength (both pull-out and shear strengths) to the listed fasteners. If fasteners do not achieve a minimum holding strength of 750 pounds when connected to steel, the fastener size or the connecting material thickness or strength shall be increased until the minimum holding strengths are achieved.

1.8.2.1 Screws shall not be less than No. 14 diameter if self-tapping type and not less than No. 12 diameter if self-drilling and self-tapping type.

1.8.2.2 If screws strip during installation, they shall be replaced with the next larger size screw of the same type or with a bolt equal in size to the stripped fastener.

1.8.2.3 One-fourth (1/4) inch diameter bolts with appropriate washers and nuts may be used in lieu of the screw fasteners given above.

1.8.3 Hold-Down Clips:

1.8.3.1 Two fasteners shall be used to connect hold-down clips to the structural members below.

1.8.3.2 Hold-down clips shall be capable of allowing for full anticipated thermal movement. The clips shall be positioned at the time of installation with due consideration of the ambient temperature in relation to the temperature range expected during the lift of the roofing system.

1.8.4 Gravity design loads for the roofing panels and for the subpurlins, or panel support system, shall be the sum of the actual dead load and a vertical live load of 30 pounds per square foot.

1.8.5 Maximum deflections under the applied gravity vertical live load shall not exceed those listed below. Deflections shall be based on the member being continuous across 2 or more supports, unfastened, and free to rotate.

Roofing Panels: 1/180 of the span

Subpurlins, or Panel Support Beams: 1/180 of the span

1.8.6 Resistance to Wind Uplift: The standing seam metal roof system components shall be from a single, tested roof deck construction system listed in the Underwriters' Laboratories, Inc., "Building Materials Directory for Class 90 WindUplift." The standing seam metal roof system as installed shall be essentially the same as the UL tested system except as modified by requirements of the roofing system manufacturer to accommodate the specifics of this project. The roof system installed shall be structurally equivalent to the UL Class 90 tested system with regard to its capacity to resist wind uplift. The Contractor may assume that the primary structural supporting members of the building (as indicated on the Contract Drawings) are adequate to withstand the metal roof system need consider those primary supporting members only as required for connection of the standing seam metal roof system to the supporting structural members.

1.8.7 Other Components: Connection devices which are used by the manufacturer as "standard" edge connections at gables, ridges, eaves, etc., must resist wind upload forces. Edge connection devices shall have wind uplift resistance equal to the hold-down clips proposed for use in the roof

area adjacent to the edge connector. For devices with movable components, tension pull tests shall be performed in the installed condition of the edge connector that is least resistant to wind uplift. The tests shall be performed only if certified manufacturer test results for prior installed standing seam metal roof systems cannot be obtained.

PART 2 PRODUCTS

2.1 MANUFACTURERS

2.1.1 Refer to U.S. Army Corps of Engineers attached to the end of this Section.

2.1.2 Metal Sales, East 2727 Trout Ave., Spokane, WA 99202, 800-572-6565, or equal.

2.2 MATERIALS

2.2.1 Metal Roof/Fascia Panels: Panels shall be supplied by a manufacturer located within 500 miles of project site. Panels shall be coil-coated and color-finished as specified herein, and shall have configurations designed for mechanically formed seams for securing adjacent sheets. The system for securing the roof covering to structural framing members shall be concealed clip fastening system with nonpenetrating fasteners. The ridge shall not have exposed fasteners. Sealant for the standing seams shall be factory applied. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope. Sheets shall be square-cut, except gable wall sheets or hip sheets may be cut in the shop to correspond to the roof slope. Panels shall be fabricated of zinc-coated steel conforming to ASTM A 446-91, G90 coating designation; aluminum-zinc alloy-coated steel conforming to ASTM A 792-89 with AZ-50 coating designation, Grade 40 or to suit the manufacturer's standards; or aluminum-coated steel conforming to ASTM A 463-88 with T1-40 and Mil Spec MIL-S-4174, Type II. The nominal thickness of the steel sheets prior to forming and coating shall be 24 gauge or thicker.

2.2.1.2 Factory Color Finish: Roof panels shall have a factory color finish on the exposed side. The exterior finish shall consist of either a synthetic resin base coating applied to a cleaned, pretreated, and primed surface, or a dry-film coating bonded by adhesive to a cleaned metal substrate. Color shall be Federal No. 37056. The dry film thickness of the exterior coating shall be not less than 0.8 mil, exclusive of the primer. The interior color finish shall consist of the same coating and dry film thickness as the exterior or backer coat with a dry film thickness of 0.5 mil. The exterior color finish shall meet the test requirements specified below. The manufacturer shall have conducted tests on previously manufactured sheets of the same type and finish as proposed for this project. The term "appearance of base metal" refers to the metal coating on steel base metal.

2.2.1.2.1 Salt Spray Test: A sample of the sheets shall withstand a salt spray test for a minimum of 1,000 hours in accordance with ASTM B 117-90, including a scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating

of 10, no blistering, as determined by ASTM D 714-87; and a rating of 7, 1/6 inch failure at scribe, as determined by ASTM D 1654-92.

2.2.1.2.2 Formability Test: When subjected to a 180-degree bend over a 3/8 inch diameter mandrel, exterior coating film shall show no evidence of fracturing to the naked eye.

2.2.1.2.3 Accelerated Weathering, Chalking Resistance, and Color Change: A sample of the sheets shall withstand a weathering test a minimum of 2,000 hours in accordance with ASTM G 23-92, using a Type D apparatus, without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from the base metal with a pen-knife blade or similar instrument shall be considered as an area indicating loss of adhesion. After the 2,000 hour weatherometer test, exterior coating shall not chalk greater than No. 8 rating in accordance with ASTM D 659 test procedures. After the 2,000 hour weatherometer test, exterior coating color change shall not exceed 2 NBS units in accordance with ASTM D 2244-89.

2.2.1.2.4 Humidity Test. When subjected to a humidity cabinet test in accordance with ASTM D 2247-92 for 1,000 hours, a scored panel shall show no signs of blistering, cracking, creepage, or corrosion.

2.2.1.2.5 Impact Resistance. Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794-92 equal to 1.5 times metal thickness in mils, expressed in inch-pounds, with no loss of adhesion.

2.2.1.2.6 Abrasion Resistant Test. When subjected to the falling sand test in accordance with ASTM D 968 E1-81, the coating systems shall withstand a minimum of 30 liters of sand before the appearance of base metal.

2.2.1.2.7 Specular Gloss: Finished surfaces shall have a specular gloss value of 30 to 70 at angle of 60 deg in accordance with ASTM D 523-89.

2.2.2 Accessories. Flashing, trim, molded closure strips, ridge caps, and similar metal accessories shall not be less than the minimum thickness specified for metal roofing panels. Accessories shall be compatible with the roofing panels furnished. Exposed metal accessories shall have a factory color finish to match the panels furnished. Molded closure strips shall be closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the roofing and shall not absorb or retain water.

2.2.3 Fascia Panels: Fascia panels shall be of same material and finish as the metal roof panels. Fascia panels shall also be subject to the same tests and performance requirements as the metal roof panels. The only exception to the above is vertical loading requirements as the fascia panels are installed in a vertical configuration rather than a sloped configuration.

2.2.4 Metal Roof Panel Support Structure: Secondary framing members, trusses, and secondary structural members shall conform to Specifications as provided by Butler Manufacturing Company for the MR-24 Roof System or approved equal, and as specified below:

2.2.4.1 Secondary structural members, except columns and beams, shall be the manufacturer's standard sections fabricated from 14 gauge cold-formed galvanized steel.

2.2.4.2 Unless otherwise shown, subpurlins shall be located above and anchored to the existing wood structural deck with bolts or screws. When additional subpurlins, which cannot be attached to purlins are needed, they shall be anchored to the existing wood structural deck with blind screw-type expandable fasteners. Anchor plates for subpurlin supports shall sit directly on the existing wood deck surface. This will require cutting of holes in existing single-ply membrane roofing and rigid insulation so that support plates are in direct contact with the wood deck. (Note: Contractor must patch roof to match existing surrounding surfaces including insulation.)

2.2.5 Fascia Support Structure:

2.2.5.1 Metal Studs: 8 inch 16 gauge and 4 inch 20 gauge galvanized steel studs at 24 inch o.c.

2.2.5.2 Furring: 7/8 inch galvanized steel furring channels or manufacturer's approved equal.

2.2.5.3 Expansion Bolts: 1/2 inch diameter x 6 inch long galvanized A36 steel expansion bolts w/washers and nuts.

2.2.6 Miscellaneous Materials:

2.2.6.1 Hold-Down Clips: Two-piece high-strength 304 stainless steel concealed hold-down clips capable of allowing + 1.25 inch movement in each direction for thermal expansion and contraction. Each concealed hold-down clip shall be secured by two (2) fasteners to supporting structure.

2.2.6.2 Insulation: Unfaced, preformed, rigid, cellular, polyurethane thermal insulation complying with ASTM C 591-85, Type 2 with aged R-values of 6.2 at 75 deg F. Insulation shall be installed in areas where selective demolition of the existing built-up roof deck was performed.

2.2.6.3 Insulating Compounds and Gaskets: Nonabsorptive and suitable for insulating contact points of incompatible materials.

2.2.6.4 Thermal/Sound Spacer: A Polystyrene 3/8 inch minimum, 2-3/8 inch maximum, 4 inch minimum width, 16 inch or 18 inch length sized to fit between panel clips Thermal Spacer shall be installed over the truss. The thermal spacer shall be installed with a bead of tube sealant or bead mastic. Installer shall take care that the thermal spacer be slightly compressed and fit between the purlin and roofing panel. This installation

shall be made to reduce any drumming effect from the roofing panel to the truss.

2.2.6.5 Roof Vent Extensions: Fabricated from 20 gauge zinc-coated sheet steel and finished to match roof panels above roof line.

2.2.6.6 Fasteners: Zinc-coated steel, corrosion-resistant steel, or nylon-capped steel as approved by the manufacturer for applicable uses. Exposed fasteners shall be gasketed or have gasketed washers on the exterior side of the covering to waterproof the penetration. Washer material shall be compatible with the covering, have a minimum diameter of 3/8-inch for structural connections, and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 1/8-inch thick. Nonpenetrating fastener systems using concealed clips shall be the manufacturer's standard for the system provided.

2.2.6.7 Soffits: 24 gauge vented screen fabricated from roll-formed steel or manufacturer's standard soffit for system provided.

2.2.6.8 Continuous Snow Guards: Snow guards as manufactured by Alpine Snow Guards, Pipe-style Snow Guards, #4000 with #75 tubing or equal. Contractor to ensure that installation of the snow guards does not interfere with the warranty certification required for the SSMR system.

2.2.6.9 Sealants: Use only urethane sealants. Silicone sealants are not acceptable for use with SSMR.

2.2.6.10 Slip Sheet: #15 asphalt-saturated roofing felt or rosin paper.

2.2.6.11 Ice/Water Shield: Minimum 40-mil thick, self adhering membrane composed of a non-granular surfaced, high density, embossed polyethylene film coated on one side with a layer of rubberized asphalt, meeting requirements of ASTM D 1970. "Vycor Ice and Water Shield" manufactured by W.R. Grace and Co.-Conn or equal.

At eaves and ridges parallel with the steel roof deck flutes; position membrane sheets so that side-laps are made over the top of metal deck flutes. Secure additional pieces of 24-gauge sheet metal to underlying steel roof deck at membrane end laps for flat, sound surface to bond overlap. Where steel deck flutes are not parallel to the membrane layout at valleys/hips; provide additional 24-gauge sheet metal 2'-6" (minimum) both sides of valley/hip centerlines for solid bonding surface for membrane.

Roof Tie Offs: Manufactured by Latchways Fall Arrest Systems. System for standing seam metal roofing complying with OSHA Standard 1926.502.

STANDARD TEST METHOD FOR STRUCTURAL PERFORMANCE OF SSMRS BY UNIFORM STATIC AIR PRESSURE DIFFERENCE

1. Scope

1.1 This test method covers the determination of the structural performance of standing seam metal roof systems under uniform static air

pressure differences, using a test chamber.

1.2. The proper use of this test method requires a knowledge of principles of pressure and deflection measurement.

1.3. This test method describes the apparatus to be used for applying specific test loads uniformly distributed to a specimen.

1.4. The values states in inch-pound units are to be regarded as the standard. The metric equivalents of inch-pound units may be approximate.

1.5. This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Descriptions of terms specific to this standard.

2.1. Specimen - The entire assembled unit submitted for test as described in Section 6.

2.2. Test Load - The specified difference in static air pressure (positive or negative) for which the specimen is to be tested, expressed in pounds-force per square foot (or pascals).

2.3. Ultimate Load - The difference in static air pressure (positive or negative) at which failure of the specimen occurs, expressed in pounds per square foot (or pascals).

2.4. Permanent Deformation - The permanent displacement from an original position that remains after an applied load has been removed.

2.5. Failure - The inability to carry additional load, permanent separation of the panels or of any of the component parts or connections, or when permanent deformation is sufficient to compromise the weatherability of the roof system.

3. Summary of Method

This test method consists of sealing the test specimen onto the face of a test chamber, supplying air to or exhausting air from the chamber at the rate required to maintain the test-pressure difference across the specimen, and observing, measuring, and recording the deflections, deformations, and nature of any failures of principal or critical members.

4. Significance and Use

4.1. This test method is a standard procedure for determining structural performance under uniform static air pressure difference. This typically is intended to represent the effects of wind loads on building roof systems.

4.2. The test loads shall be the roof uplift pressures multiplied by the

factor of safety. The factor of safety against yielding of the panels shall be 1.3. The factor of safety against all other failure modes shall be 1.65 or 140 psf, whichever is less. The pressure multiplied by 1.65 or 140 psf shall be the maximum pressure required in the test.

5. Apparatus

5.1. The description of the apparatus is general in nature; any equipment capable of performing the test procedure within the allowable tolerances is permitted.

5.2. Major Components

5.2.1. Test Chamber - A test chamber or box with an open top upon which the specimen is installed. At least one static pressure tap shall be provided to measure the chamber pressure and shall be so located that the reading is unaffected by the velocity of the air supply to or from the chamber or any other air movement. The air supply opening into the chamber shall be arranged so the air does not impinge directly onto the test specimen with any significant velocity. A means of access into the chamber may be provided to facilitate adjustments and observations after the specimen has been installed.

5.2.2. The test chamber or the specimen mounting frame, or both, must not deflect under the test load in such a manner that the performance of the specimen will be affected.

5.2.3. Air System - A controllable blower, compressed air supply, an exhaust system, or reversible controllable blower designed to provide the required maximum air pressure difference across the specimen. The system shall provide an essentially constant air pressure difference for the required test period.

5.2.4. Pressure-Measuring Apparatus - A device to measure the test pressure difference within a tolerance of plus or minus 2 percent.

5.2.5. Deflection-Measuring Apparatus - A means of measuring deflections within a tolerance of plus or minus 0.01 inch.

5.2.5.1. Deflections shall be measured at the midpoint between supporting roof members. These measurements shall be taken along the standing seam and at the midpoint of the panels between standing seams. Deflection of edge members that are part of the roof systems shall also be measured at similar locations. Additional measurements may be required by the specified.

5.2.5.2. When deflections are to be measured, the deflection gauges shall be installed so that the deflections of the components can be measured without being influenced by possible movements of, or movements within, the specimen or member supports.

6. Test Specimens

6.1. Specimens shall be of sufficient size to determine the performance of

all parts of the system (approximately 10 feet by 20 feet). All parts of the test specimen shall be full size, using the same materials, details, and methods of construction and anchorage as in the manufacturer's established system. Two specimens shall be required to perform the test. There shall be one specimen representing the corner condition and a second specimen representing the construction in the middle portion of the roof.

6.2. Width: Edge seals shall not contain structural attachments that restrict deflection of the test panels other than through the normal gable conditions.

6.3. Length: Spacing of the supports shall be the actual spacing of the panel spans being evaluated with appropriate panel overhangs, if any, at end supports. The minimum number of spans to be tested is three and the minimum length is 15 feet.

7. Calibration

Calibration of manometers and deflection-measuring devices is required prior to start of the test.

8. Required Information

8.1. In specifying this method the following information shall be supplied by the specifying authority:

8.1.1. The number of incremental loads and the positive and negative test loads at these increments at which deflection measurements are required, if different from paragraphs 9.2 and 9.3.

8.1.2. The duration of incremental and maximum loads, if different for paragraph 9.3.

8.1.3. The number and location of required deflection measurements. See paragraph 5.2.5.1.

9. Procedure

9.1. Fit the specimen upon the chamber opening. Support and secure the specimen by the same number and type of anchors used in installing the manufacturer's established system.

9.1.1. If air leakage through the test specimen is excessive, tape may be used to cover any cracks and joints through which the leakage is occurring.

Tape shall not be used when there is a probability that it may significantly restrict differential movement between adjoining members. It is also permissible to cover the entire specimen and mounting panel with a single thickness of polyethylene film no thicker than 6 mils (0.006 in) (0.152 mm). Panels should be tested in such a manner that 100 percent of the exposed panel surface has a uniform static air pressure difference applied giving particular attention to ensuring that this load is applied between or behind all framing support members. The technique of application is important in order that full load is permitted to be transferred to the specimen and that the membrane does not prevent

movement or failure of the specimen. Apply the film loosely with extra folds of material at each corner and at all offsets and recesses. When the load is applied, there will be no fillet caused by tightness of plastic film that will have a significant effect on the results.

9.2. Install any required deflection-measuring devices at their specified locations. A minimum of 6 points on the load-deflection curve shall be obtained.

9.3. Apply a nominal pressure equal to at least four times the dead weight of the specimen. Use this nominal pressure as the "reference zero load" and record initial readings after the applied load has been applied for 60 seconds and until dial gauges indicate no further increase in deflection. The next load, unless otherwise specified, shall be a load equal to one-quarter the design wind uplift load and shall be applied for not less than 60 seconds. Thereafter, reduce the pressure difference to no load and then back to "reference zero load." Take readings to determine the permanent deformation or failure. Continue to apply loading in 5 increments reducing loading after each increment back down to no load and then back to "reference zero load" until the design wind uplift load is achieved. After completion of the above portion of the test, reduce the pressure difference to no load and then back to "reference zero load." Multiply the design wind uplift load by the factor of safety. Using one-third increments of this value, increase the load in three steps until this factored load is reached. Follow the same procedure as used to test to design load. Hold the test at final load for a minimum of 60 seconds then reduce the load to zero. If failure occurs prior to the full load, record the load at the time of failure.

10. Report

10.1 The report shall include the following information:

10.1.1. Date of the test and the report.

10.1.2. Identification of the specimen (manufacturer, source of supply, dimensions, model types, materials, and other pertinent information).

10.1.3. Detailed Drawings of the specimen, showing dimensioned section profiles, framing location, panel arrangement, installation and spacing of anchorage, and any other pertinent construction details. Any modifications made on the specimen to obtain the reported values shall be noted on the Drawings.

10.1.4. A tabulation of the number of the test load increments, the pressure differences exerted across the specimen at these increments, the pertinent deflections at these pressure difference, and permanent deformations at locations specified for each specimen tested.

10.1.5. The duration of test loads, including incremental loads.

10.1.6. A record of visual observations of performance.

10.1.7. When the tests are made to check conformity of the specimen to a

particular Specification, an identification or description of that Specification.

10.1.8. A statement that the tests were conducted in accordance with this test method, or a full description of any deviations from this test method.

10.1.9. A statement as to whether or not tape or film, or both, were used to seal against air leakage, and whether in the judgment of the test engineer, the tape or film influenced the results of the test.

10.1.10. If several essentially identical specimens of a component are tested, results for all specimens shall be reported, each specimen being properly identified particularly with respect to distinguishing features or differing adjustments. A separate Drawing for each specimen will not be required if all differences between them are noted on the Drawing provide.

10.1.11. The test shall be performed by an independent testing laboratory or at the manufacturer's laboratory if an independent Registered Professional Engineer witnesses the test. In either case, the test report shall be signed and sealed by the engineer who witnessed the test.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Installation shall be performed by the manufacturer's authorized installers, in accordance with the approved erection instructions and Drawings and requirements specified herein, or in accordance with submitted Shop Drawings as approved by the Contracting Officer. The roof system supplier shall furnish a representative, at the job site, who is experienced in the erection of the roof system being installed, for the entire installation of the roof system. The representative shall be either an employee of the manufacturer with at least three (3) years experience in installing the proposed roofing system or an employee of an independent installer that is certified by the roofing system manufacturer to have three (3) years experience installing the roofing system being proposed. Qualifications of the job site representative shall be submitted for review and approval by the Contracting Officer.

3.1.2 Dissimilar materials which are not compatible shall be insulated from each other by means of gaskets and insulating compounds. Premolded closure strips shall be installed wherever covering sheets terminate in an open-end configuration, exclusive of flashings. The closure strip installation shall provide a watertight and weathertight closure. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign materials. Stained, discolored, improperly drilled or damaged sheets shall be removed from the project site.

3.1.3 Comply with the manufacturer's instructions and recommendations for installation, as applicable to projection conditions and supporting substrates. Anchor panels and other components of the work securely in place, with provisions for thermal and structural movement.

3.1.3.1 Field cutting of roof panels by torch is not permitted.

3.1.3.2 Install panels with concealed fasteners and clips.

3.1.3.3 Install components required for a complete roofing system including trim, copings, fascia panels, corner units, ridge closures, clips, thermal block, seam covers, flashings, exterior gutters, sealants, gaskets, fillers, closure strips, soffit panels and vents, vent extensions, and similar items.

3.1.3.4 Install vents, pipes, etc., cutouts in roof panel shall be centered between the SSMR ribs to preclude flashing over the rib.

3.2 INSTALLATION

3.2.1 Metal Roof Panels: Fasten roof panels to supports with concealed hold-down clips in accordance with the manufacturer's instructions.

3.2.1.1 Install clips at each support with self-tapping fasteners.

3.2.1.2 Roofing panels shall be applied with the longitudinal configurations in the direction of the roof slope. Side laps shall have factory applied sealant. Joints at accessories shall be sealed as recommended by the manufacturer.

3.2.1.3 Complete seaming of panel joints by operation of a potable power-driven seaming machine of the type recommended by the panel manufacturer to provide a weathertight joint.

3.2.2 Metal Fascia Panels: Install in same manner as roofing panels. Factory fabricated internal and external corner units with mitered joints shall be provided where fascia changes direction of run. Provide and install closure strips, shaped trim pieces, and flashings where fascia panels meet roofing panels, as recommended by the manufacturer.

3.2.3 Soffits: Install as shown on the Contract Drawings or as recommended by the manufacturer.

3.2.4 Roof/Fascia Panel Support Structure: Install as shown on the Contract Drawings or as recommended by the manufacturer.

3.3 SLIPSHEET INSTALLATION

3.3.1 Felt Underlayment: Install felt underlayment and building-paper slip sheet on roof sheathing under metal roof panels, unless otherwise recommended by metal roof panel manufacturer. Use adhesive for temporary anchorage, where possible, to minimize use of mechanical fasteners under metal roof panels. Apply at locations indicated on Drawings in shingle fashion to shed water, with lapped joints of not less than 2 inches.

Apply from eave to ridge.

Apply on roof not covered by self-adhering sheet underlayment. Lap edges of self-adhering sheet underlayment not less than 3 inches, in shingle fashion to shed water.

3.4 INSTALLATION TOLERANCES

Shim and align panel units within installed tolerances of 1/4 inch in 20 foot - 0 inch on level/plumb/slope and location/line as indicated on the Contract Drawings or as approved on submitted Shop Drawings, and within 1/8 inch offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING AND PROTECTION

3.4.1 Damaged Units: Replace panels and other components of the work that have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures.

3.4.2 Cleaning: Remove temporary protective coverings and strippable films (if any) as soon as each panel is installed. Upon completion of panel installation, clean finished surfaces as recommended by the panel manufacturer, and maintain in a clean condition during the construction period.

PART 4 QUALITY CONTROL PROCEDURES

4.1 QUALITY CONTROL RECORD

Complete AF Form 1063 daily as follows:

4.1.1 Top Section:

- Insert date and record number.
- Insert weather description and temperature.
- Indicate crew start/stop times.
- Indicate your start/stop times.
- Indicate total roof area.
- Indicate roof area completed previous to date.

4.1.2 Products Section: This section is divided into major categories. Each category may include several materials:

4.1.2.1 Examine each material within the category and check proper box.

4.1.2.2 Check the "not applicable" box for work materials not included.

4.1.2.3 Assure that all materials in a category comply with the Contract to result in a check in the "complies" box. To determine compliance, compare the material with the project Specifications, Drawings, and also with the approved manufacturer's literature submitted. Since materials other than those covered by the components listed may be used, enter their compliance in the "all other materials" category.

4.1.3 Execution Section:

4.1.3.1 The work item numbers in this section of the record correspond to the work items in these basic QC requirements. The work items are Specification items considered to be a major concern. These items are

in the basic QC requirements for convenience and tabulation.

4.1.3.2 Performance of the "actions" below the work item will result in an entry in the proper box on the QC record. Specification items not in the basic QC requirements must also be considered, and their acceptability grouped and documented in the "other" box.

4.1.4 Variance Section:

4.1.4.1 An entry in any "varies" box under the "products" or "execution" sections requires an explanation of the variance in this section. The explanation should be limited to a description of the variance only; reasons for variances are not necessary.

4.1.4.2 Indicate action taken to resolve each variance to result in complying work. If a variance is not resolved on the same day it occurs, the number of that day's record must be entered in the space provided on records for all succeeding days, until the variance is resolved.

4.1.5 Closing Section: Sign the record at the end of the workday and submit it to the Government inspector.

4.2 WORK ITEMS

4.2.1 Work Item 1: Do not expose materials to moisture in any form before, during, or after delivery to the site.

Action: Inspect materials upon delivery for intact manufacturer's shipping containers. Verify the vehicle delivering materials provided adequate cover for protection of materials. Inspect materials for evidence of contact with moisture before acceptance. Inspect job site storage; ascertain enclosed storage to protect materials from moisture from any source. Observe material handling from storage areas to roof. Delivery to job site requires the same attention as delivery to the storage area. Mark conspicuously all materials exposed to any form of moisture and have them permanently removed from the project site.

4.2.2 Work Item 2: Execute the work so that each area of the installation is completed on the same work day it is begun. Included are all flashings, metal trim shapes, closure strips, and all other related parts to complete assembly.

Action: Determine the area of work planned and ascertain that enough materials are at hand to complete it. Inspect work at day's end and verify completion to "tie-in" point.

4.2.3 Work Item 3: Install temporary water cutoffs and tie-ins at the end of each work day. Remove cutoffs and tie-ins on resuming work day so that all vertical faces of insulation are exposed.

Action: None.

4.2.4 Work Item 4: Except for expedient temporary work, do not proceed

with roofing work during inclement weather or when the ambient temperature is below 45 deg F or projected to fall below 45 deg F at any time during each work day.

Action: During bad weather, ascertain that work being done is only temporary and protects the facility and previously completed roofing system. Assure that all temporary work is removed before installation of permanent components when work is resumed.

4.2.5 Work Item 5: Do not apply roofing system components if moisture in any form can be seen or felt on the substrate to which the components will be secured. Substrate shall be free of debris, sharp objects, films, or other contaminants.

Action: Ascertain no moisture is on deck, vapor barrier, or any other existing surfaces before applying subsequent materials. If there are objects present which present a physical danger to the new roof system, they are to be swept off or smoothed out. Water shall be broomed or pumped off and the surface allowed to dry before commencement of work. Other contaminants which may be present and not addressed here shall be prevented from coming into physical contact with new roof system.

4.2.6 Work Item 6: N/A

4.2.7 Work Item 7: N/A

4.2.8 Work Item 8: N/A

4.2.9 Work Item 9: If traffic of any kind over the partially or fully completed roofing is unavoidable, provide and use adequate plank or plywood protection for the roofing.

Action: Inspect activities and methods used to transport materials over the completed or partially completed roofing system. Check adequacy of planks of plywood to protect system.

4.2.10 Work Item 10: Do not load or permit any part of a structure to be loaded with a weight that will adversely affect its safety.

Action: Assure that runways (such as wood planks or plywood) are used to distribute the load of materials and equipment hauling over the deck so as not to cause deflection of the deck. Check for broken welds on bends in metal decking because of materials or equipment handling.

4.2.11 Work Item 11: Removal of existing materials must result in clean, dry substrate, except for residual stains, providing a surface suitable to apply and secure new materials.

Action: Inspect substrate for excessive roughness, cracks, holes, deleterious coatings, or deteriorated condition. Assure that decking or other substrate determined to be defective is repaired, replaced, or brought to the attention of the Contracting Officer. Assure that deck joints are sealed to prevent the passage of moisture.

4.2.12 Work Item 12: N/A

4.2.13 Work Item 13: N/A

4.2.14 Work Item 14: Clean seaming area using techniques required by the roofing manufacturer's Specification.

Action: This is the most critical factor and should be monitored very carefully. Accurate seaming depends on proper cleaning on both mating surfaces. If incorrectly cleaned, flanges are to be taken apart and reinstalled.

4.2.15 Work Item 15: Probe seams for defects.

Action: Check all outside edges of the seam along its entire length. The completed seams shall be visually free of any voids, fishmouths, wrinkles, and shall be configured perfectly vertical.

4.2.16 Work Item 16: N/A

4.2.17 Work Item 17: N/A

-- End of Section --

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SECTION 07600

FLASHING AND SHEETMETAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2002) Structural Welding Code - Steel

AWS D1.2 (1997) Structural Welding Code Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A 653/A 653M (2002) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 924/A 924M (1999) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM B 209/B 209M (2001) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 32 (2000) Standard Specification for Solder Metal

ASTM C 920 (2001) Standard Specification for Elastomeric Joint Sealants

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA ASMM (1993) Architectural Sheet Metal Manual

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Fabrication drawings for the following items shall include material, description, and thickness.

Installation drawings shall indicate location, dimensions, configuration, construction details, type of seams and fastening method for the following items:

Fabrication and installation drawings for accessories shall be in accordance with paragraphs entitled, "Minimum Dimensions and Thicknesses" and "Miscellaneous Components," and shall meet all design specifications as required by referenced standards within this section.

Flashing
Sheet Metal

SD-07 Certificates

Certificates for the following items shall be submitted showing conformance with referenced standards contained in this section.

Fasteners
Solder Materials
Cement
Sealing Compound

Certificates for the following types of sheetmetal shall be submitted showing conformance with referenced standards contained in this section.

Aluminum

Galvanized Steel

Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.

Include similar Samples of trim and accessories involving color selection.

1.3 QUALITY ASSURANCE

Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

Unload, store, and install sheet metal flashing materials and fabrications

in a manner to prevent bending, warping, twisting, and surface damage.

Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.5 COORDINATION

Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 PRODUCTS

2.1 SHEET METAL MATERIALS

2.1.1 Aluminum

Sheet and strip aluminum shall be Alclad 3003 conforming to ASTM B 209/B 209M, embossed finish, clad one side and specified temper. Minimum tensile strength shall be 23,000 psi.

2.1.2 Galvanized Steel

Galvanized steel sheet shall conform to ASTM A 924/A 924M and ASTM A 653/A 653M, regular coating, designation Z90.

2.1.3 Minimum Dimensions and Thicknesses

Materials shall be in accordance with SMACNA ASMM and shall be not less than the following minimum thicknesses and weights.

<u>ITEM</u>	<u>ALUMINUM, THICKNESS INCH</u>	<u>GALVAN- IZED STEEL, GAGE</u>
Bellows or flanges, U-type	---	24
Flashings		
Base	0.032	22
Cap, roof penetration cap flashing, equipment and structural supports, pitch pans	0.032	24

<u>ITEM</u>	<u>ALUMINUM, THICKNESS INCH</u>	<u>GALVAN- IZED STEEL, GAGE</u>
Through-wall, above roof line, including coping and parapet	---	24
Cleats, 2 inches by 3 inches	0.032	26
Edge strips, 1-1/4 inches wide	0.050	24
Cap flashing receivers	---	24
Gutters and downspouts:		
Gutter sections, end caps	0.032	24
Continuous cleats, cover plates	0.032	24
Downspouts, con- ductor heads	0.024	24
Strainer wire gage/diameter	0.144 dia.	0.12 dia.
Downspout hangers, 2 inch	0.125 inch	10
Gutter hangers, 1 inch wide	0.125	10
Splash pans	0.040	22

2.2 CEMENTS AND SEALING COMPOUNDS

2.2.1 Sealing Compound

Sealant shall be on elastomeric, (Type M) multiple -component, nonsag or gunnable (Grade NS) Class 50 sealant, conforming to ASTM C 920. Base material shall be polysulfide.

Aluminum-seam sealant shall be as recommended by the aluminum manufacturer.

2.3 SOLDER MATERIALS

Solder and flux shall meet the requirements of ASTM B 32. Solder shall be

SN50.

2.4 FASTENERS

Fasteners shall be the same metal or a metal compatible with the material joined.

PART 3 EXECUTION

3.1 GENERAL

Sheetmetal work shall conform to drawing details and to the applicable plate number and design and installation recommendations of SMACNA ASMM. Finished sheetmetal installation shall be free from water leakage.

Surfaces to receive sheetmetal work shall be clean, smooth, dry, and free from defects and projections which might affect the work. Surfaces shall be plumb and true to a tolerance of not more than 1/2 inch in 40 feet, with no dips, waves, or uneven surfaces exceeding 1/8 inch in 10 feet in any direction. Lines, arises, and angles shall be sharp and uniform. Exposed edges of sheetmetal shall be folded back to form a 1/2-inch wide hem on the concealed side.

3.1.1 Fastening Methods

Fasteners shall be concealed. Only one edge shall be nailed to permit freedom of expansion perpendicular to the line of nailing. Nails shall be spaced at not more than 3 inches on center. Nails shall penetrate backing by not less than 1 inch.

Cleats shall be used for securing edges of sheetmetal members over 12-inches wide and at other designated locations. Cleats shall be fastened with two nails and the end folded over the nails. Other end of the cleat shall be locked into the seam or the folded edge of member being fastened. Cleats shall be spaced at not more than 12 inches on center.

Screws shall be fitted with neoprene washers to protect surface of metal sheet and provide a watertight connection.

3.1.2 Seams

Seams and lock joint construction shall conform to SMACNA ASMM, Plates 99.

Seams shall be straight and uniform in height, width, and finish as follows:

Lap seams.

Joints, seams, and connections of aluminum shall be welded except where a screw or riveted and hard-setting sealant connection is indicated.

Loose-lock expansion seams shall be not less than 3-inches wide and shall provide for not less than a 1-inch movement within the joint. Joint shall be completely filled with the specified sealant applied at not less than 1/8-inch bed thickness.

Flat seams shall be made in the direction of flow. Seams not soldered shall be completely filled with plastic cement.

Surfaces to be joined by soldering shall be cleaned, pretinned, heated, fluxed, and sweat-soldered through the full contact area in accordance with the best standards of practice in modern sheet metal shops. Flux residue and foreign matter shall be removed after soldering. Soldered surfaces shall be rinsed with water and wiped clean.

Procedures for manual shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting welding work shall conform to AWS D1.1/D1.1M and AWS D1.2.

3.1.3 Dissimilar Metals

Dissimilar metals shall be isolated from each other by painting with bituminous paint.

3.2 FLASHING

3.2.1 Base Flashing

Metal base flashing shall be installed where the roof abuts vertical surfaces, in valleys, at ridges, and where the roof slope changes. Configuration shall conform to SMACNA ASMM.

Flashing shall extend not less than 8 inches up vertical surfaces.

3.2.2 Cap and Counter Flashing

Metal cap or counter flashing shall be installed where horizontal roof surfaces abut vertical wall surfaces, at copings, at joints between existing and new construction, at penetrations of roof surfaces, and at equipment supports. Configuration shall conform to SMACNA ASMM.

Flashing shall be formed in 10-foot lengths, except where shorter pieces are required; end joints shall be lapped not less than 3 inches. Joints shall not be soldered.

3.2.3 Edge Strips

Edge trim strips shall have a formed drip edge.

3.2.4 Flashing at Roof Penetrations and Equipment Supports

Metal flashing conforming to SMACNA ASMM, shall be installed where piping, conduit, or equipment supports penetrate roof surfaces.

Single-pipe vents shall be flashed with lead flashing or a two-piece formed-metal housing of the specified sheetmetal, installed as indicated in SMACNA ASMM.

3.3 GUTTERS AND DOWNSPOUTS

3.3.1 Gutters

Gutter design shall be in accordance with SMACNA ASMM.

Gutters shall be set level to a tolerance not to exceed 1/2 inch in 40 feet.

Gutters shall be pitched to drain at not more than 1/16 inch per foot.

Gutters supports shall be in accordance with SMACNA ASMM. Support spacing shall not exceed 30 inches on center.

Back edges of gutters shall be folded to form a continuous hook not less than 1/2-inch deep. Gutters shall be supported by continuous cleat of not less than a 2-1/2-inch width.

Outlet tubes with flanges shall be riveted and soldered to gutters; tubes shall be extended 3 inches into downspouts.

A downspout strainer shall be inserted into each outlet tube.

Gutter expansion joints shall be provided at a spacing of not more than 32 feet on center in accordance with SMACNA ASMM.

3.3.2 Downspouts

Downspouts shall be provided on outside walls from gutters, conductor heads, and scuppers.

Downspouts shall be joined to the gutters at outlet tubes and joined to each other by telescoping end joints 1-1/2 inches into the lower section.

Downspout hangers shall be fabricated of the same material as downspouts. One hanger shall be provided at the top and bottom of each downspout section.

Elbows shall be installed where downspouts terminate on splash blocks or roof pans. Downspouts shall be fitted neatly into cast-iron boots or drain pipes where downspouts terminate in drainage lines; joints shall be filled to the full height of the bell with portland-cement mortar caps.

3.4 CLEANING

Exposed sheetmetal work shall be cleaned of all surface contaminants and imperfections at completion of installation.

-- End of Section --

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SECTION 07840

FIRESTOPPING

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Firestopping Materials

Detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resist Dir or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgement, derived from similar UL system designs or other tests, shall be submitted for review and approval prior to installation. Submittal shall indicate the firestopping material to be provided for each type of application. When more than 5 penetrations or construction joints are to receive firestopping, drawings shall indicate location and type of application.

SD-07 Certificates

Firestopping Materials

Certificates attesting that firestopping material complies with the specified requirements. In lieu of certificates, drawings showing UL classified materials as part of a tested assembly may be provided. Drawings showing evidence of testing by an alternate nationally recognized independent laboratory may be substituted.

Installer Qualifications

Documentation of training and experience.

Inspection

Manufacturer's representative certification stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

1.2 GENERAL REQUIREMENTS

Firestopping shall consist of furnishing and installing tested and listed firestop systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint. Gaps requiring firestopping include gaps between the curtain wall and the floor slab and between the top of the fire-rated walls and the roof or floor deck above.

1.3 STORAGE AND DELIVERY

Materials shall be delivered in the original unopened packages or containers showing name of the manufacturer and the brand name. Materials shall be stored off the ground and shall be protected from damage and exposure to elements. Damaged or deteriorated materials shall be removed from the site.

1.4 INSTALLER QUALIFICATIONS

The Contractor shall engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years experience in the installation of manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer qualification on the buyer. The Installer shall have been trained by a direct representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures.

1.5 COORDINATION

The specified work shall be coordinated with other trades. Firestopping materials, at penetrations of pipes and ducts, shall be applied prior to insulating, unless insulation meets requirements specified for firestopping. Firestopping materials at building joints and construction gaps shall be applied prior to completion of enclosing walls or assemblies. Cast-in-place firestop devices shall be located and installed in place before concrete placement. Pipe, conduit or cable bundles shall be installed through cast-in-place device after concrete placement but before area is concealed or made inaccessible.

PART 2 PRODUCTS

2.1 FIRESTOPPING MATERIALS

Firestopping materials shall consist of commercially manufactured, asbestos-free products complying with the following minimum requirements:

2.1.1 Fire Hazard Classification

Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E 84 or UL 723. Material shall be an approved firestopping material as listed in UL Fire Resist Dir or by a nationally recognized testing laboratory.

2.1.2 Toxicity

Material shall be nontoxic to humans at all stages of application.

2.1.3 Fire Resistance Rating

Firestopping will not be required to have a greater fire resistance rating than that of the assembly in which it is being placed.

2.1.4 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph GENERAL REQUIREMENTS, shall provide "F" and "T" fire resistance ratings in accordance with ASTM E 814 or UL 1479. Fire resistance ratings shall be as follows:

- a. Penetrations of Fire Resistance Rated Walls and Partitions: F Rating = One hour.

2.1.5 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph GENERAL REQUIREMENTS, and gaps such as those between floor slabs or roof decks and curtain walls shall be the same as the construction in which they occur. Construction joints and gaps shall be provided with firestopping materials and systems that have been tested per ASTM E 119 or UL 2079 to meet the required fire resistance rating. Systems installed at construction joints shall meet the cycling requirements of ASTM E 1399 or UL 2079.

PART 3 EXECUTION

3.1 PREPARATION

Areas to receive firestopping shall be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system. For cast-in-place firestop devices, formwork or metal deck to receive device prior to concrete placement shall be sound and capable of supporting device.

3.2 INSTALLATION

Firestopping material shall completely fill void spaces regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping systems for filling floor voids 100 mm or more in any direction shall be capable of supporting the same load as the floor is designed to support or shall be protected by a permanent barrier to

prevent loading or traffic in the firestopped area. Firestopping shall be installed in accordance with manufacturer's written instructions. Tested and listed firestop systems shall be provided in the following locations, except in floor slabs on grade:

- a. Penetrations of duct, conduit, tubing, cable and pipe through fire-resistance rated wall and partition assemblies.
- b. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.
- c. Construction joints in fire rated walls and partitions.
- d. Other locations where required to maintain fire resistance rating of the construction.

3.2.1 Insulated Pipes and Ducts

Thermal insulation shall be cut and removed where pipes or ducts pass through firestopping, unless insulation meets requirements specified for firestopping. Thermal insulation shall be replaced with a material having equal thermal insulating and firestopping characteristics.

3.2.2 Fire Dampers

Fire dampers shall be installed and firestopped in accordance with Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

3.3 INSPECTION

Firestopped areas shall not be covered or enclosed until inspection is complete and approved. A manufacturer's representative shall inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements.

-- End of Section --

SECTION 07901

JOINT SEALANTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.2 SUMMARY

This Section includes joint sealants for the following locations:

Exterior joints in vertical surfaces and non-traffic horizontal surfaces as indicated below:

Control and expansion joints in unit masonry.
Perimeter joints between materials listed above and frames of doors and windows.
Other joints as indicated.

Exterior joints in horizontal traffic surfaces as indicated below:

Control, expansion, and isolation joints in cast-in-place concrete slabs.
Other joints as indicated.

Interior joints in vertical surfaces and horizontal non-traffic surfaces as indicated below:

Perimeter joints of exterior openings where indicated.
Perimeter joints between interior wall surfaces and frames of interior doors and windows.
Perimeter joints of toilet fixtures.
Tile control and expansion joints.
Other joints as indicated.

Interior joints in horizontal traffic surfaces as indicated below:

Control and expansion joints in tile flooring.
Other joints as indicated.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.

Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are

water resistant and cause no staining or deterioration of joint substrates.

1.4 SUBMITTALS

Hi-lite all descriptive literature to accomplish identification of specific components/items which are proposed to be furnished. Government will not react to descriptive material/literature which has not been hi-lited, except to reject the Submittal.

Product data from manufacturers for each joint sealant product required.

Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.

Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.

Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

SD-12 LEED Submittals per Section 01352

1. Credit EQ 4.1: Manufacturer's product data for interior sealants including printed statement of VOC content.

1.5 QUALITY ASSURANCE

Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:

When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.

When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40 deg F.

When joint substrates are wet.

Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.

Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.8 SEQUENCING AND SCHEDULING

Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Available Products: Interior sealants subject to compliance with Section 01352 "LEED Requirements."

Pecora Corporation, 165 Wambold Road, Harleysville PA 19438 Phone: (215) 723-6051 (800) 523-6688, Fax: (215) 721-0286.

Tremco, Inc., Sealants Div., 220 Wickstead Ave., Toronto, ON Phone: (416) 292-5108.

Sika Corp., 201 Polito Ave., Lyndhurst, NJ 07071 Phone: (201) 933-8800 Fax: (201) 933-6225.

GE Silicones, 260 Hudson River Road, Waterford, NY 12188 Phone: (800) 332-3390, Fax: (518) 233-3795.

Equal approved by Contracting Officer.

2.2 JOINT SEALANT MATERIALS

Sealant #1:

Type: Single component moisture curing polyurethane sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT, M, A, and O.

Movement capability: 25 percent in extension and compression.

Products:

Pecora Dynatrol I - XL.

Tremco Dymonic.
Sika Sikaflex-1A.
Equal approved by Contracting Officer.

Color: At masonry and metal panels, match color. At doors and windows, dark bronze.

Sealant #2:

Type: Single component moisture curing polyurethane sealant; ASTM C 920, Type S, Grade P, Class 25, Use T, M, A, and O.
Movement capability: 25 percent in extension and compression.
Products:

Pecora NR-201.
Sika Sikaflex-1CSL.
Equal approved by Contracting Officer.

Color: Gray.

Sealant #3:

Type: Single component neutral moisture curing silicone sealant; ASTM C 920, Type S, Grade NS, Class 25, USDA Approved, Use NT, M, G, and A.
Movement capability: 25 percent in extension and compression.
Products:

Pecora 898.
GE Sanitary 1700.
Equal approved by Contracting Officer.

Color: Match grout color.

2.3 JOINT SEALANT BACKING

General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

Plastic Foam Joint Fillers: Preformed, compressible, resilient, non-staining, non-waxing, non-extruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

Open-cell polyurethane foam.
Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, non-outgassing in unruptured state.
Proprietary, reticulated, closed-cell polymeric foam, non-outgassing, with a density of 2.5 pcf and tensile strength of 35 psi per ASTM D 1623, and with water absorption less than 0.02 g/cc per ASTM C 1083.
Any material indicated above.

2.4 MISCELLANEOUS MATERIALS

Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.

Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.

Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.1 EXAMINATION

Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.2 PREPARATION

Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:

Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.

Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

Remove laitance and form release agents from concrete.

Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

Do not leave gaps between ends of joint fillers.
Do not stretch, twist, puncture, or tear joint fillers.
Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.

Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.

Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.4 CLEANING

Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that and installations with repaired areas are indistinguishable from original work.

3.6 SCHEDULE

Sealant #1:

Masonry expansion and control joints.
Perimeter joints at frames of doors and windows-interior and exterior.
Penetrations in exterior wall system.

Sealant #2:

Control, expansion, and isolation joints in interior and exterior concrete slabs.

Sealant #3:

Tile control and expansion joints.
When tile meets another surface (ex: casework, painted gyp. bd).
Perimeter joints of bathroom fixtures.

-- End of Section --

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SECTION 08100

METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2004) Structural Welding Code - Steel

DOOR AND HARDWARE INSTITUTE (DHI)

DHI A115.1 (1990) Preparation for Mortise Locks for 1-3/8 Inch 35 millimeter and 1-3/4 Inch 44 millimeter Doors

DHI A115.2 (1988) Door and Frame Preparation for Bored or Cylindrical Locks for 1-3/8 Inch 35 millimeter and 1-3/4 Inch 44 millimeter Doors

DHI A115.4 (1994) Standard Steel Door and Frame Preparation for Lever Extension Flush Bolts

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1999) Standard for Fire Doors and Fire Windows

STEEL DOOR INSTITUTE (SDI)

SDI 100 (1998) Standard Steel Doors and Frames

SDI 105 (1991) Erection Instructions for Steel Frames

1.2 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Fabrication drawings for the following items shall show location and size of all holes to be punched for hardware attachment, size, shape, gage and finish.

Steel Doors
Frames

SD-02 Shop Drawings

Installation drawings for the following items shall be in accordance with the paragraph entitled, "Installation," of this section.

Steel Doors
Frames

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Steel Doors
Frames
Finish Hardware
Reinforcement

SD-07 Certificates

Certificates for the following items shall be submitted showing conformance with referenced standards contained in this section.

Steel Doors
Frames
Finish Hardware
Reinforcement

SD-12 LEED Submittals per Section 01352

1. Credit MR 4.1 and 4.2: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products containing recycled content.
 - a. Include statements indicating unit costs for products having recycled content.

1.4 DELIVERY, HANDLING, AND STORAGE

Doors, frames, and accessories shall be protected from damage during handling, transportation, and at the job site. Materials shall be stored at the site, under cover, and on wood blocking or suitable floors.

1.5 GENERAL REQUIREMENTS

Section 05095, "Welding Steel Construction," applies to work specified in this section.

PART 2 PRODUCTS

2.1 GENERAL

Doors, frames, and accessories shall conform to SDI 100 and the requirements specified herein.

Welding shall be in accordance with the recommended practice of the Structural Welding Code, Sections 1 through 6, AWS D1.1/D1.1M and as specified by the producer of the metal being welded. Welds behind finished surfaces shall cause no distortion or discoloration on the exposed side.

2.1.1 Steel Doors

Doors shall be heavy duty, 1-3/4-inch, 18-gage, full flush or seamless hollow steel construction, electrolytic zinc-coated with honeycomb core reinforcement.

Door louvers shall be inserted type.

Exterior louvers shall be provided with a 14- by 18-mesh bronze insect screen secured to the louvers on the interior side of the door.

Panel moldings on the exterior side of doors and the corridor side of interior doors shall be nonremovable. Panel molding on the interior side of doors shall be removable.

Fire-rated doors shall be the types that have been investigated and fire tested as a fire door assembly, complete with the type of fire door hardware to be used in the work. Fire-rated doors shall be labeled with the applicable fire rating of the door construction provided.

2.1.2 Frames

Exterior frames shall be 16-gage full welded-unit-type.

Interior frames shall be 16-gage full welded-unit type.

Fire-rated frames shall be the types that have been investigated and fire tested as an assembly, complete with the type of hardware to be used in the work. Fire-rated frames shall be labeled with the applicable fire rating of the frame construction provided.

2.2 FINISH HARDWARE PREPARATIONS AND LOCATIONS

Preparation for hardware shall be in accordance with DHI A115.1, DHI A115.2, and DHI A115.4, as applicable.

Frames, except fire-rated labeled frames, shall be punched to receive molded-rubber door silencers. Single door frames shall be punched for three silencers in the lock side jamb. Double door frames shall be punched

for one silencer in each leaf of the frame head. Lock strikes shall be set out to provide clearance for the silencer.

Hardware locations shall comply with SDI 100, Table V, except when template dimensions and multiple-item installations require an alternative location.

Reinforcement for finished hardware shall meet or exceed the requirements of SDI 100, Table IV.

2.3 FINISHING

Doors and frames shall be primed and finished in accordance with SDI 100.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Door Clearance

Clearances shall be those specified in SDI 100.

Clearances for fire-rated doors shall be as specified in NFPA 80.

3.1.2 Frame Installation and Tolerances

Frames shall be installed in accordance with SDI 105.

Fire-rated frames shall be installed in accordance with NFPA 80.

Frames shall be installed within the following tolerances:

Deviation in location from that indicated on the drawings	Plus or minus 1/4 inch
---	------------------------

Deviation from plumb or horizontal:

In 8 feet	Not more than 1/16 inch
-----------	-------------------------

In 12 feet	Not more than 1/8 inch
------------	------------------------

3.1.3 Finish-Hardware Installation

Hardware shall be installed and adjusted in accordance with the hardware manufacturer's printed directions.

After the installation is completed, hardware shall be adjusted and lubricated to ensure proper performance.

3.1.4 Final Adjustment

Before final acceptance, finish hardware shall be checked and readjusted as required to ensure proper operation of the finish hardware.

-- End of Section --

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SECTION 08120

ALUMINUM DOORS AND FRAMES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ALUMINUM ASSOCIATION (AA)

AA 45 (2003) Designation System for Aluminum Finishes

AA SAS-30 (1996) Specifications for Aluminum Structures Construction Manual Series Section 1

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 350 (1999) Load and Resistance Factor Design (LFRD) Specification for Structural Steel Buildings

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-671 (1989) Specification & Commentary for the Design of Cold-Formed Steel Structural Members

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B18.22.1 (1975; R 1998) Plain Washers

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4 (1998) Standard Symbols for Welding, Brazing and Nondestructive Examination

AWS A5.1 (2003) Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding

AWS D1.1/D1.1M (2004) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M (2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 153/A 153M (2004) Standard Specification for Zinc

	Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 27/A 27M	(2003) Standard Specification for Steel Castings, Carbon, for General Application
ASTM A 283/A 283M	(2003) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A 307	(2003) Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A 36/A 36M	(2003a) Standard Specification for Carbon Structural Steel
ASTM A 47/A 47M	(1999) Standard Specification for Ferritic Malleable Iron Castings
ASTM A 501	(2001) Standard Specification for Hot-Formed Welded and Seamless Carbon-Steel Structural Tubing
ASTM A 563	(2004) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A 570/A 570M	(1998) Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
ASTM B 136	(2003) Standard Method for Measurement of Stain Resistance of Anodic Coatings on Aluminum
ASTM B 137	(1995; R 2000) Standard Test Method for Measurement of Mass of Coating on Anodically Coated Aluminum
ASTM B 209/B 209M	(2004) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 211	(2003) Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire
ASTM B 221/B 221M	(2003) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 244	(1997; R 2002) Standard Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments

ASTM B 316/B 316M (2002) Standard Specification for Aluminum and Aluminum-Alloy Rivet and Cold Heading Wire and Rods

ASTM C 509 (2000) Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.1 (2000) Butts and Hinges

BHMA A156.18 (2003) Hardware - Materials and Finishes

BHMA A156.4 (2000) Door Controls (Closers)

BHMA A156.5 (2001) Auxiliary Locks & Associated Products

BHMA A156.6 (2001) Architectural Doors and Trim

INTERNATIONAL CODE COUNCIL (ICC)

ICC A117.1 (1998) American National Standards for Accessible and Usable Buildings and Facilities

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS FF-B-588 (Rev D) Bolt, Toggle; and Expansion Sleeve, Screw

FS FF-S-325 (Int Amd 3) Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)

FS FF-W-84 (Rev A; Am 3) Washers, Lock (Spring)

FS TT-C-494 (Rev B; Notice 1) Coating Compound, Bituminous, Solvent Type, Acid Resistant

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir (2003) Building Materials Directory

1.2 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.3 PERFORMANCE REQUIREMENTS

1.3.1 Allowable Design Stresses

Aluminum-Alloy framing member allowable design stresses shall be in accordance with AA SAS-30 for the specified aluminum alloy.

Hot-rolled Structural Steel member allowable design stresses and design rules shall be in accordance with AISC 350 for the specified structural steel.

Cold-formed light-gage steel structural member allowable design stresses and design rules shall be in accordance with AISI SG-671, for the specified structural-steel Sheet and Strip.

1.3.2 Design Wind Load

Design wind load shall be 90 MPH, Exposure C.

1.3.3 Structural Requirements

Doors and frames shall be designed to withstand the specified design wind load acting normal to the plane of the entrance wall either inward or outward.

Deflection of any metal framing member in a direction normal to the plane of the entrance wall, when the glazed entrance is subjected to the specified wind pressure, shall not exceed 1/175 of the clear span of the member or 3/4 inch, whichever value is the lesser.

Deflection of any metal member in a direction parallel to the plane of the entrance wall, when the metal member is carrying its full design load, shall not exceed 75 percent of the design clearance dimension between that member and the glass, sash, panel, or other part immediately below it.

1.3.4 Provisions for Thermal Movement

Doors and frames shall be designed to provide for expansion and contraction of the component parts caused by an ambient temperature range of 0 to 100 degrees F without causing buckling, opening of joints, overstressing of fasteners, or other harmful effects.

1.4 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Fabrication drawings for the following items shall be in accordance with the paragraph entitled, "Fabrication," of this section.

Finish Hardware
Aluminum Doors

Frames

SD-02 Shop Drawings

Installation drawings shall include the following information:

Door and frame locations in the building, layout and elevations, dimensions, shapes and sizes of members, thicknesses of metals, types and locations of shop and field connections, details of anchorage to other construction, method of glazing, and other pertinent construction and erection details.

Welds shall be in accordance with AWS A2.4 welding symbols.

Location and details of materials that are to be embedded in cast-in-place concrete and masonry construction.

A finish hardware schedule indicating type, quantity, manufacturer's name, catalog number, location, and finish.

Finish Hardware
Aluminum Doors
Frames

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Aluminum Doors
Paint Materials
Glazing Materials
Finish Hardware
Installation Materials
Thresholds
Frames
Weatherstripping

SD-04 Samples

Contractor shall submit the following samples:

An Aluminum Finish for exposed-to-view surfaces, approximately 3-inches wide by 6-inches long, to illustrate the aluminum producer's standard color and appearance range.

Preformed Glazing Gaskets, full size by 12 inches long.

Anchorage Devices and Fasteners, one full size of each type to be used in the work.

Lock Cylinders, one full size.

After approval, full size samples may be used in the construction,

provided each is clearly identified and its location is recorded.

SD-05 Design Data

Design analysis and calculations for the following items shall indicate the allowable design loads as specified in the paragraph entitled, "Performance Requirements," of this section.

- Aluminum Doors
- Frames
- Aluminum Alloy
- Structural Steel
- Sheet and Strip

SD-06 Test Reports

Test reports shall be in accordance with the paragraph entitled, "Finishes, Except Hardware," of this section, for anodic coating tests.

SD-07 Certificates

Certificates shall be submitted for the following items showing conformance with referenced standards contained in this section.

- Metals for Fabrication
- Paint Materials
- Glazing Materials
- Finish Hardware
- Installation Materials

SD-08 Manufacturer's Instructions

Preventive Maintenance and Inspection for the following shall be in accordance with the paragraph entitled, "Finishes, Except Hardware," of this section.

- Cleaning Materials
- Application Methods

SD-10 Operation and Maintenance Data

Operation and maintenance manuals shall be submitted for the following items:

- Finish Hardware
- Aluminum Doors
- Frames

SD-12 LEED Submittals per Section 01352

1. Credit MR 4.1 and 4.2: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products containing recycled content.

- a. Include statements indicating costs for products having recycled content.

1.5 QUALIFICATIONS FOR WELDING WORK

Welding processes shall be in accordance with AWS D1.1/D1.1M. Contracting Officer reserves the right to require that test specimens be made in the presence of an authorized representative and that such test specimens be tested by an approved laboratory.

Welders shall have been qualified by tests in accordance with AWS D1.1/D1.1M. In addition to the above requirements, tests shall be performed on test pieces in positions and with clearances equivalent to those actually encountered in construction. When a test weld fails to meet requirements, an immediate retest of two test welds shall be made, and each test weld shall pass. Failure of the retest shall require that the welder be retested after further practice or training and that a complete set of test welds be made.

1.6 APPROVING AUTHORITY

References to the need for approval in AWS D1.1/D1.1M shall mean approval by the Contracting Officer, and all references to the Building Commissioner shall mean the Contracting Officer.

1.7 DELIVERY, HANDLING, AND STORAGE

Doors, frames, and accessories shall be protected from damage during handling, transportation, and at the job site. Materials shall be stored at the site under cover on wood blocking or on suitable floors.

Packaged materials shall be stored in their original, unopened packages.

1.8 FIELD MEASUREMENTS

Field measurements shall be taken prior to the preparation of drawings and fabrication.

PART 2 PRODUCTS

2.1 METALS FOR FABRICATION

2.1.1 Aluminum-Alloy Extrusions

Extrusions shall conform to ASTM B 221/B 221M.

Alloy and temper shall be 6063-T5.

Alloy and temper shall be that recommended by the aluminum producer for the specified anodic coating with integral color and shall have mechanical properties equal to or exceeding those of 6063-T5.

Sheets and plates shall conform to ASTM B 209/B 209M, Alloy 5005, and Temper H16.

2.1.2 Structural Steel

Hot-rolled shapes, plates, and bars shall conform to ASTM A 36/A 36M.

Hot-formed tubing shall conform to ASTM A 501.

Sheet and strip for cold-formed light gage structural members shall conform to ASTM A 570/A 570M, Grade 33.

2.1.3 Metals for Fasteners

Metals for fasteners shall be a type recommended by the door manufacturer, or as follows:

Aluminum-alloy bolts and screws from rod conforming to ASTM B 211, Alloy 2024 and Temper T351

Aluminum-alloy nuts from rod conforming to ASTM B 211, Alloy 6061 and Temper T6

Aluminum-alloy washers from sheet conforming to ASTM B 209/B 209M, Alloy 2024 and Temper T4

Aluminum-alloy rivets from rod or wire conforming to ASTM B 316/B 316M, Alloy 6053 and Temper T61

Corrosion-resistant non staining, non bleeding steel fasteners from corrosion-resistant chromium-nickel steel, form and condition best suited for the work, compatible with adjacent materials.

2.2 PAINT MATERIALS

Shop paint for aluminum shall conform to FS TT-C-494, Type II, bituminous solvent type.

Shop paint for steel shall be the manufacturer's standard rust-inhibiting primer.

2.3 GLAZING MATERIALS

Preformed Glazing Gaskets shall be elastomeric compression type, extruded to shape with factory-made tight fitting corners to suit the type of flush glazing and glass size.

Material shall conform to ASTM C 509.

2.4 FINISH HARDWARE

2.4.1 Overhead Surface-Mounted Door Closers

Surface-mounted door closers shall be liquid-controlled, rack-and-pinion construction, of a size best suited for the door weight and opening, conforming to BHMA A156.4, Type C02011. Closers shall be the product of

one manufacturer.

Closer arms and mounting brackets shall be provided as required. Drop plates shall be provided, sized for the door stile dimension.

2.4.2 Butt Hinges

Hinges shall be the full-mortise, template, extra-heavy, ball bearing, five-knuckle type with button tips, conforming to BHMA A156.1, Type A2111. Hinges for exterior out-swinging doors shall have pins that cannot be removed when the door is in the closed position. Hinges shall be the product of one manufacturer.

2.4.3 Door Pulls

Door pulls shall be extruded aluminum and of the door manufacturer's standard push-pull plate type.

2.4.4 Pushbars

Pushbars shall be extruded aluminum and of the door manufacturer's standard single bar type.

Pushbars shall be extruded aluminum and of the door manufacturer's standard single bar type, with attached pushplate having design matching the door pull used.

2.4.5 Deadlocks

Deadlocks shall be mortised, one-point maximum-security type. Backset dimensions, front shape, and hand shall be suitable for the door stile. Deadlock shall receive the lock cylinder specified, without modification.

2.4.6 Lock Cylinders

Cylinders complying with BHMA A156.5, shall encase interchangeable seven-pin tumbler cores. Temporary cores shall be provided and maintained for each cylinder during the construction period and removed when directed. Security cores will be installed by the Government.

2.4.7 Pull Handles

Handles shall be extruded aluminum, door manufacturer's standard panic device pull handle.

2.4.8 Panic Exit Devices

Exit devices shall be the top- and bottom-locking type with vertical rods concealed in door stiles. Devices shall be listed in UL Bld Mat Dir and shall bear the UL label.

Exit devices shall be in accordance with ICC A117.1 for handicap requirements.

Soffit strikes, sill strikes, and dogging keys shall be provided.

2.4.9 Thresholds

Thresholds shall be extruded aluminum for doors hung on butt or pivot hinges, with grooved tread, conforming to BHMA A156.6, Type J601.

2.4.10 Hardware Finishes

Finish designations are Builders' Hardware Manufacturer Association (BHMA) code numbers, and conform to BHMA A156.18.

Finish of door pulls, pushbars, deadlocks, lock cylinders, and flush bolts shall be the same as that specified for doors and frames.

Panic exit devices shall be BHMA Code US10B.

2.5 FABRICATION

2.5.1 Workmanship

Metal parts shall be accurately formed. Joints, except those designed to accommodate movement, shall be accurately fitted and rigidly assembled.

Welding shall be in accordance with AWS D1.1/D1.1M and shall be done with filler metals and by methods recommended by the producer of the metal being welded. Welds behind finished surfaces shall cause no distortion or discoloration on the exposed side. Welded joints shall be cleaned of all welding flux and dressed on all exposed and contact surfaces.

Insofar as practical, fitting and assembly of the work shall be done in the manufacturer's plant. Work that cannot be permanently factory assembled shall be marked before shipment for proper assembly at the site.

2.5.2 Preparation for Finish Hardware

Preparations for mortised and concealed hardware shall be done at the factory and shall include cutouts, recesses, mortises, reinforcing, drilling, and tapping to receive the specified hardware sets. Preparations for hardware shall be made to the template of the manufacturer of each hardware item. Where concealed closers and other mechanisms are required, the necessary space, cutouts, reinforcement, and provisions for secure fastening shall be made. Where butt or pivot hinges are required, doors and frames shall be reinforced with backing plates to ensure adequate strength of the fastening.

2.5.3 Protection of Aluminum from Dissimilar Materials

Surfaces that will come in contact with dissimilar metals, masonry, concrete, or wood shall be shop primed.

Surfaces shall be given one shop coat of paint which shall be applied to dry, clean surfaces to provide a continuous minimum dry-film thickness of 1.5 mils (0.0015 inch).

2.5.4 Aluminum Doors

Doors shall be swing type, full glazed, stile-and-rail construction with medium stile, of the size indicated.

Stiles and rails shall be fabricated of aluminum-alloy tubular extrusions having a wall thickness not less than 0.125 inch. Corners shall be joined by both concealed welding and mechanical fastening. Corner connections shall be accurately milled to a hairline watertight joint.

Single swing doors shall have not more than 3/32-inch clearance at jambs and heads, 3/16-inch clearance at meeting edges of pairs of doors, and 1/2-inch clearance at the bottom. Dimensions are nominal and subject to the manufacturer's tolerances. Lock edges of doors shall provide the proper operating clearance.

Glazing moldings shall be fabricated of aluminum-alloy extrusions with wall thicknesses not less than 0.050 inch. Moldings shall be the snap-in flush glazing type with preformed glazing gasket, sized to receive the type and thickness of the glass. Moldings on the exterior face of doors shall be the nonremovable type without exposed screws. Moldings shall be carefully fitted and joined at corners.

2.5.5 Frames

Frames shall be of the section dimensions and arrangements indicated.

Frames shall be fabricated of aluminum-alloy extrusions with a wall thickness of not less than 0.125 inch. Frame joints shall be sealed to prevent leakage. Door stops applied to the frames shall be secured with concealed fasteners. Anchors shall be provided for securing the frames to building construction. Sizes, shapes, and methods of anchoring shall be as detailed on the approved drawings.

Structural steel members required for the reinforcement of framing sections shall be provided with the frames and shall be hot-rolled shapes, hot-formed tubing, or cold-formed light-gage steel. Reinforcement shall be concealed inside the frame members.

Glazed openings in frames shall be designed for flush glazing. Glazing moldings and preformed glazing gaskets shall be as specified for doors.

2.5.6 Finishes, Except Hardware

Preventive Maintenance and Inspection for the aluminum manufacturer's recommended Cleaning Materials and Application Methods shall be submitted, including detrimental effects to the aluminum finish when improperly applied.

Aluminum Finish for exposed-to-view aluminum surfaces of the doors and frames shall be polished frosted finish with Class II clear anodic coating.

Finish shall be a smooth specular buffed mechanical finish followed by a medium matte chemical-etch finish and Architectural Class II (0.4- to

0.7-mil thickness) anodic coating producing a natural aluminum color. Finish shall conform to M12-C22-A31 as defined in AA 45.

Aluminum finish for exposed-to-view aluminum surfaces of doors and frames shall be polished frosted finish with integral-color anodic coating.

Smooth specular buffed mechanical finish shall be followed by nonetching inhibitive alkaline cleaning, medium matte chemical etch finish, and an Architectural Class I (0.7-mil and greater thickness) anodic-coating-producing integral-color finish. Finish shall conform to M21-C12-C22-A42 as defined in AA 45. Colors shall be:

Dark bronze

Finish color and appearance shall match that of the sample approved for use in the project within the aluminum producer's standard color range.

Anodic coating on aluminum shall be tested for thickness in accordance with ASTM B 244.

Anodically coated aluminum shall be tested for the weight of the coating in accordance with ASTM B 137.

Resistance of anodically coated aluminum to staining by dyes shall be tested in accordance with ASTM B 136.

2.5.7 Hardware Locations

Hardware locations shall be as follows:

<u>HARDWARE ITEM</u>	<u>LOCATION</u>
Door handles	Centerline of grip 42 inches above the floor
Door pulls	Top fastening 45 inches above the floor
Pushbars, single	Centerline 45 inches above the floor
Deadlocks	Centerline of strike 60 inches above the floor
Panic exit devices	Centerline of strike 40-5/16 inches above the floor
Top butt hinges	11-3/4 inches from the rabbet section of the head of the frame to the centerline of the hinge
Bottom butt hinges	13 inches from the finished floor to the centerline of the hinge
Intermediate butt hinges	Equally spaced between the top and bottom butt hinges

HARDWARE ITEMLOCATION

Pivot hinges (top, bottom, and intermediate)	In accordance with the pivot manu- facturer's printed instructions
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2.5.8 Weatherstripping

Exterior doors shall be provided with weatherstripping at heads, jambs, and meeting stiles.

Weatherstripping shall be silicone treated wool pile inserted in a corrosion-resistant steel or extruded aluminum-alloy housing. Weatherstripping at meeting stiles of pairs of doors shall be adjustable. Weatherstripping shall be mortised into the door edges, or frame, or both, as required to suit the conditions. Weatherstripping shall be designed for easy removal and replacement.

2.6 INSTALLATION MATERIALS

2.6.1 Threaded-Type Concrete Inserts

Inserts shall be galvanized ferrous castings having enlarged bases with not less than two nailing lugs, length not more than the thickness of the concrete less 3/4 inch, and internally threaded to receive 3/4-inch diameter machine bolts. Castings shall conform to ASTM A 47/A 47M. Inserts shall be galvanized in accordance with ASTM A 153/A 153M after fabrication.

Inserts shall not be removable when embedded in 3,000-pound per square inch (psi) concrete and subjected to a 10,000-pound tension load test in an axial direction, nor shall the concrete show any evidence of failure attributable to installation of the anchorage device itself.

2.6.2 Wedge Concrete Inserts

Inserts shall be galvanized box-type ferrous castings with an integral loop at the back of the box and designed to accept 3/4-inch diameter bolts having special wedge-shaped heads. Castings shall conform to ASTM A 47/A 47M, Grade 32510 or 35018, or ASTM A 27/A 27M, Grade U-60-30. Inserts shall be galvanized after fabrication in accordance with ASTM A 153/A 153M.

Inserts shall not be removable when embedded in 3,000-psi concrete and subjected to a 16,000-pound tension load test in an axial direction, nor shall the concrete show any evidence of failure attributable to installation of the anchoring device itself.

Carbon-steel bolts having special wedge shape heads, nuts, washers, and shims, galvanized in accordance with ASTM A 153/A 153M, shall be provided.

2.6.3 Slotted Concrete Inserts

Inserts shall be the galvanized, pressed-steel plate, welded construction,

box type, with slots designed to receive 3/4-inch diameter square-head bolts and to provide lateral adjustment of the bolt. Length of the insert body less the anchorage lugs shall be not less than 4-1/2 inches. Inserts shall be provided with knockout covers. Steel plate shall be not less than 1/8 inch thick, conforming to ASTM A 283/A 283M, Grade C. Inserts shall be galvanized in accordance with ASTM A 123/A 123M after fabrication.

Inserts shall not be removable when embedded in 3,000-psi concrete and subjected to a 6,000-pound tension load test in an axial direction, nor shall the concrete show any evidence of failure attributable to installation of the anchoring device itself.

2.6.4 Masonry-Anchorage Devices

Devices shall be expansion shields conforming to FS FF-S-325, group, type, and class as follows:

Shields for machine screws 1/4-inch and smaller shall be lead group, head-out embedded nut type, single unit class, conforming to Group I, Type 1, Class 1.

Shields for standard steel bolts and machine screws larger than 1/4-inch shall be lead group, head-out embedded nut type, multiple unit class, conforming to Group I, Type 1, Class 2.

2.6.5 Toggle Bolts

Toggle bolts shall be tumble-wing type, class and style best suited for the work, conforming to FS FF-B-588, Type II.

2.6.6 Standard Threaded Fasteners

Standard threaded fasteners shall be as follows:

Standard steel bolts: Regular hexagon head, low-carbon steel, coarse-thread series, conforming to ASTM A 307.

Nuts: Plain hexagon, regular style, carbon steel, conforming to ASTM A 563.

Plain washers: Round, general assembly purpose grade, carbon steel, conforming to ANSI B18.22.1.

Lockwashers: Helical-spring, carbon steel, of the style best suited for the work, conforming to FS FF-W-84, Class A.

2.6.7 Electrodes for Welding Steel

Electrodes for welding steel by the manual shielded metal-arc welding process shall meet the requirements of AWS D1.1/D1.1M and shall be covered mild-steel electrodes conforming to AWS A5.1, E60 series.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Doors, Frames and Accessories

Doors, frames, and accessories shall be installed in accordance with the approved shop drawings and descriptive data.

3.1.2 Materials Embedded in Other Construction

Materials such as cement boxes for checking floor hinges, concrete inserts, and anchor bolts, which are to be embedded in cast-in-place concrete and masonry construction, shall be delivered to the project site in time to be installed before the start of the other construction. Setting drawings, templates, instructions, and directions shall be provided for the installation of the embedded materials.

3.1.3 Fastening to Construction-in-Place

Anchorage devices and fasteners shall be provided where necessary for fastening the specified work to construction in place and shall include threaded fasteners for concrete inserts embedded in cast-in-place concrete, masonry anchorage devices and threaded fasteners for solid masonry and concrete in place, toggle bolts for hollow masonry and stud partitions, and connections for structural steel. Fastening shall be provided as specified. Fastening to wood plugs in masonry or concrete in place is not permitted.

3.1.4 Setting Masonry Anchorage Devices

Devices shall be set in masonry or concrete in place in accordance with the manufacturer's printed instructions. Holes shall be the recommended depth and diameter and shall be drilled using the drill recommended by the manufacturer of the particular anchorage device used. Drilled holes shall be left rough, not reamed, and free from drill dust.

3.1.5 Field Welding Steel, Touchup Painting

Procedures of manual shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting welding work shall conform to AWS D1.1/D1.1M.

After completion of welding, field welds and scarred surfaces on steel work and on adjacent ferrous-metal surfaces shall be touchup painted. Before start of touchup painting, weld scars, bruises, abrasions, and rust spots shall be wire brushed and solvent cleaned. Paint used for touchup painting shall conform with LEED VOC limits set forth in Section 01352.

3.1.6 Installation Tolerances

Doors and frames shall be installed in a manner not to exceed the following limits of tolerance:

Deviation in location from that indicated on the drawings	Plus or minus 1/4 inch
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Deviation from the plumb or horizontal:

In 12 feet	Not more than 1/8 inch
In 24 or more feet	Not more than 1/4 inch
Offset from true alignment at joints between members in line end-to-end	Not more than 1/16 inch

3.1.7 Placing Frames

Supporting members, including materials embedded in other construction, shall be completely in place before placing frames. Framing members shall be installed plumb, level, and in alignment within the limits of the installation tolerances specified. Temporary supports and bracing shall be provided as required to maintain the position, stability, and alignment of the framing members while they are being permanently connected.

3.1.8 Door Installation

Doors shall fit accurately in frames within the specified door clearances.

3.1.9 Finish Hardware Installation

Contractor shall drill and tap as required for the application of surface-mounted finish hardware. True position shall be located by template to ensure accurate placement. Hardware items shall be installed in accordance with the manufacturer's printed instructions.

Thresholds shall be bedded in mastic and secured with corrosion-resistant steel flathead machine screws and lead expansion shields.

After installation is completed, hardware shall be adjusted and lubricated to ensure proper performance.

3.2 CLEANING

Upon completion of the installation, work shall be cleaned to remove all mastic smears and other foreign materials.

Before final acceptance, exposed-to-view aluminum surfaces shall be thoroughly washed with clean water and soap and rinsed with clean water. Acid solutions, steel wool, or other harsh abrasives shall not be used. Stains that remain after washing shall be removed or the finish restored in accordance with the aluminum producer's recommendations.

3.3 FINAL ADJUSTMENT

Before final acceptance, finish hardware shall be checked and readjusted as required to ensure proper operation.

3.4 ACCEPTANCE PROVISIONS

Doors and frames will be rejected for, but not limited to, any of the following deficiencies:

Exposed-to-view aluminum surfaces having color and appearance that are outside the color and appearance range of the approved samples for aluminum finish

Doors and frames not conforming to the requirements for installation tolerances and door clearances specified

Hardware that is not complete and operating properly

Doors and frames having stained, discolored, abraded, or otherwise damaged exposed-to-view aluminum surfaces that cannot be restored by cleaning or repairing

3.5 REPAIR OF DEFECTIVE WORK

Defective work shall be removed and replaced with new at no additional cost to the Government.

-- End of Section --

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SECTION 08210

WOOD DOORS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

WINDOWS AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

NWWDA I.S. 1 (1999) Wood Flush Doors

1.2 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Fabrication drawings shall show locations and dimensions for the following items:

Solid Core Doors
Fire-Rated Labeled Doors

SD-02 Shop Drawings

Installation drawings shall be submitted for the following items:

Solid Core Doors
Fire-Rated Labeled Doors
Facing
Cutout Openings
Finish Hardware

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Solid Core Doors
Fire Rated Labeled Doors
Facing

Cutout Openings
Door Louvers

SD-07 Certificates

Certificates shall be submitted for the following items showing conformance with referenced standards contained in this section.

Solid Core Doors
Fire Rated Labeled Doors
Facing

SD-12 LEED Submittals per Section 01352

1. Credit EQ 4.2: Manufacturer's product data for paints and coatings, including printed statement of VOC content and chemical components for all paints and coatings applied on-site.
2. Credit MR 7: Product Data for FSC certified wood.
 - a. A copy of the wood supplier's Chain of Custody certificate issued by an FSC-accredited certifying agency; and
 - b. A copy of the supplier's invoice detailing the quantities of certified wood products supplied for this project, with the FSC-certified status of each product listed in the individual line items (important); or
 - c. A copy of a letter from an FSC-accredited certifying agency corroborating that the products detailed on the wood supplier's invoice originate from certified well-managed forests.
 - d. Submission of a Chain of Custody certificate without an invoice or submission of an invoice without a Chain of Custody certificate shall not constitute acceptable documentation.
 - e. Proper procedures shall be followed to ensure that FSC-certified wood products are kept separate from non-certified materials and that auditing procedures as mandated by the certifier are complied with.
 - f. "Well-managed" shall mean forests that are being managed through professionally-administered forestry management and logging plans that ensure regeneration of desired species so that timber growth equals or exceeds harvesting rates in both quantity and quality over the long term. Other considerations include protecting rivers and streams from degradation, minimizing damage to the forest when harvesting, promoting biodiversity, operating in concert with the lawful interests of local populations, and maximizing both the yield and value of the forest products.

PART 2 PRODUCTS

2.1 GENERAL

Doors shall comply with the requirements of NWWDA I.S. 1, and as specified.

Door core material shall contain no urea formaldehyde. Interior wood doors shall be FSC certified, per Section 01352.

2.1.1 Manufacturers (Basis for Design)

Marshfield Signature Series, Staved Core (ESC) doors. Smartwood certification code SW-COC-675) or equal.

2.1.2 Hollow Core Doors

Hollow core wood flush doors shall be 7-ply, ladder, mesh or cellular core.

2.1.3 Solid Core Doors

Solid core wood flush doors shall be 5-ply, glue block core, or 7-ply MAT-formed particle board core. Core material shall not contain urea formaldehyde.

2.1.4 Fire-Rated Labeled Doors

Fire-rated doors and frames shall be the types that have been investigated and fire tested as a fire door assembly, complete with the type of fire-door hardware to be used in the work. Fire-rated doors and frames shall be labeled. The labels shall indicate the applicable fire rating of the door construction provided.

2.2 FACING

Facings indicated as "paint finish" shall be sound grade, conforming to NWWDA I.S. 1.

Facings indicated as stain-transparent finish shall be premium grade conforming to NWWDA I.S. 1. Face veneer and veneer cut shall be:

Red Oak, Plain Slice

2.3 BEVELING AND FITTING

Beveling and standard prefitting of wood doors shall be in accordance with NWWDA I.S. 1.

2.4 EDGE SEALING

Top and bottom edges of doors and surfaces of all cutouts shall be factory-sealed against moisture penetration.

Edges and cutouts of exterior out-swinging wood doors shall be factory sealed to preclude moisture penetration. Top and bottom rails and sills of cutouts shall receive factory-installed aluminum flashing.

2.5 DOOR FINISHING

Doors to receive a job-site-applied finish shall be clean and sanded smooth to remove handling and storage marks, raised grain, minor surface marks, and abrasions and shall be left ready for finishing as specified in Section 09920 ARCHITECTURAL PAINTING.

PART 3 EXECUTION

3.1 GENERAL

Doors shall be accurately installed in framed openings and shall maintain the specified clearances and tolerances.

Finish Hardware sets shall be installed in accordance with the approved hardware schedule and the approved drawings. Hardware shall be temporarily removed as required for job-site finishing.

After finish painting has been completed, hardware and accessories shall be reinstalled and final adjustments made for proper door operation.

3.2 ACCEPTANCE PROVISIONS

Doors will be checked by the Contracting Officer for warp, twist, delamination, and manufacturing and installation defects. Doors exhibiting defects and doors outside the tolerances listed in NWWDA I.S. 1 shall be removed and replaced with new doors.

-- End of Section --

SECTION 08361

SECTIONAL OVERHEAD DOORS

PART 1 GENERAL

1.1 SUMMARY

This Section includes the following types of sectional overhead doors:

Doors with steel-framed steel panels.

Tracks configured for the following lift types:

Normal headroom.

1.2 DEFINITIONS

Operation Cycle: One complete cycle of a door begins with the door in the closed position. The door is then moved to the open position and back to the closed position.

1.3 PERFORMANCE REQUIREMENTS

Structural Performance: Provide sectional overhead doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:

Wind Load: Uniform pressure (velocity pressure), see Structural.

Operation-Cycle Requirements: Design sectional overhead door components and operator to operate for not less than 100,000 cycles.

1.4 SUBMITTALS

Hi-lite all descriptive literature to accomplish identification of specific components/items which are proposed to be furnished. Government will not react to descriptive material/literature which has not been hi-lited, except to reject the Submittal.

Product Data: For each type and size of sectional overhead door and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:

Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.

Summary of forces and loads on walls and jambs.

Motors: Show nameplate data and ratings; characteristics; mounting

arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.

Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.

Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.

Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied finishes.

Panel: 6 inches square.

Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

Manufacturers' Certificates: Signed by manufacturers certifying that they comply with requirements specified in "Quality Assurance" Article. On request, submit evidence of manufacturing experience.

1.5 QUALITY ASSURANCE

Installer Qualifications: Engage an experienced installer who is an authorized representative of the sectional overhead door manufacturer for both installation and maintenance of units required for this Project.

Manufacturer Qualifications: Engage a firm experienced in manufacturing sectional overhead doors similar to those indicated for this Project and with a record of successful in-service performance.

Source Limitations:

Obtain operators and controls from the sectional overhead door manufacturer.

Product Options: Drawings indicate size, profiles, and dimensional requirements of sectional overhead doors and accessories and are based on the specific system indicated. Other manufacturers' systems with equal performance and dimensional characteristics may be considered. Refer to Division 1 Section "Substitutions."

Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.

The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Manufacturer: The doors will be Raynor TriCore OPTIMA steel sectional overhead type as manufactured by Raynor Garage Doors of Dixon, Illinois. Each door to be provided as one complete unit including sections, brackets, tracks, counterbalance mechanisms, and hardware to the specified opening and headroom dimensions. Door size to be selected for either rough opening size or lap jamb dimensions. Operation shall be motor (Bases for Design).

Manufacturer: CLOPAY - Model 3300.

Manufacturer: Midland Doors - Custom 3 inch insulated door.

2.2 DOOR SECTIONS

Sections shall be 3 inch thick, roll-formed from commercial-quality, hot-dipped galvanized steel per ASTM A-924 and A-653. Exterior and interior skins to have one primer coat. Door sections to be constructed of 20-gauge smooth (non-stucco) exterior skins and 20 gauge interior skins mechanically interlocked and pressure bonded to a 2-7/8 inch thick, non-CFC expanded polystyrene core. Section will have a calculated R-value of 16.05 and U-value of 0.0623. Interior and exterior skins to be separated by a continuous dual durometer vinyl extrusion held in place by a mechanical interlock to form an effective thermal break and a complete weather seal along the section joint. End stiles to be 14 gauge, separated from the exterior skin by a vinyl thermal break.

2.3 TRACK

Track shall be hot-dipped galvanized track per ASTM A-653, 2 inch or 3 inch, depending on door size. Tracks to be bracket mounted or continuous angle mounted and fully adjustable for sealing door to jamb. Continuous angle size to be not less than 2-15/16 inch x 5 inch x 3/32 inch on 2 inch track, or not less than 3-1/2 inch x 6 inch x 1/8 inch on 3 inch track. Horizontal track to be adequately reinforced with continuous angle.

2.4 HARDWARE

All hinges and brackets shall be made from galvanized steel. 2 inch or 3 inch diameter track rollers shall have hardened steel ball bearings.

2.5 SPRING COUNTERBALANCE

The spring counterbalance shall be heavy-duty oil-tempered wire torsion springs on a continuous ball-bearing cross-header shaft. Galvanized aircraft-type lifting cables with minimum safety factor of 5 to 1. Provide springs calibrated for 100,000 cycles minimum.

2.6 WEATHERSTRIPPING

Door shall be furnished with complete weatherstripping system to reduce air infiltration. Top of door to be provided with EPDM rubber sealing strip. Bottom of door to have flexible U-shaped vinyl seal in an extruded aluminum retainer. Optional jamb seal to be EPDM rubber blade type attached to track angle mounting with rigid vinyl snap-on extrusion. Weatherstripping

shall be replaceable without removal of track, angle mounting, or door hardware. Air leakage per foot of door perimeter (floor, jamb, and header) shall not exceed 0.81 CFM at 25 MPH. No air leakage shall be detected between section joints when tested in accordance with ASTM E-283.

2.7 LOCK

Door systems may be furnished with a locking device. Exterior locking shall have five-pin tumbler cylinder with night latch and steel bar engaging track. Interior locking shall have interior dead bolt provided with hole to receive padlock (padlock by others).

2.8 GLAZING

Sections may be furnished with 24 inch x 8 inch thermal type, 5/8 inch insulated glass. Glass unit shall be encased in one-piece vulcanized EPDM rubber frame. Glass can be DSB, 1/8 inch acrylic, 1/4 inch wire glass, or 3/16 inch clear glass.

2.9 WINDLOAD

Doors shall be designed to withstand 22 lbs. per sq. ft. Deflection of door in horizontal position to be maximum of 1/120th of door width.

2.10 WARRANTY

In addition to the Raynor one-year limited warranty, and subject to the conditions and limitations stated in the warranty, doors shall be free from delamination (of the insulation from its exterior and interior skins) for five years from date of installation. The expanded polystyrene will maintain its R-value for twenty years from installation date, as tested in accordance with ASTM C-236.

2.11 ELECTRIC DOOR OPERATORS

General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operational life specified, complete with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

Comply with NFPA 70.

Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging sprocket-chain operator and releasing brake for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.

Door-Operator Type: Provide unit consisting of electric motor and the following:

Trolley-Type gear-head hoist type, with enclosed worm-gear running-in-oil primary drive, chain and sprocket secondary drive, and auxiliary chain hoist and floor-level disconnect-release.

Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, single (1) phase electric motors, complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate door in either direction, from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or considering service factor.

Type: Continuous duty capacitor start motor.

Service Factor: According to NEMA MG 1, unless otherwise indicated.

Coordinate wiring requirements and electrical characteristics of motors with building electrical system.

Provide open drip proof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.

Remote-Control Station: Provide momentary-contact, 3-button control station with push-button controls labeled "Open," "Close," and "Stop."

Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor able to protect full width of door opening. Activation of sensor immediately stops and reverses downward door travel.

Sensor Edge: Provide each motorized door with an automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward door travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

Additional Control Items:

Provide an optional manual chain operator.

Provide an optional photo electric eyes and remote activation devices for each door.

PART 3 EXECUTION

3.1 EXAMINATION

Examine wall and overhead areas, including opening framing and blocking, with Installer present, for compliance with requirements for installation tolerances, clearances, and other conditions affecting performance of Work of this Section.

Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

Raynor TriCore OPTIMA steel sectional overhead type doors, including all sections, brackets, guides, tracks, and other hardware, shall be installed by an authorized Raynor Dealer according to the Drawings and Specifications herein.

3.3 ADJUSTING

Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

Adjust belt-driven motors as follows:

Use adjustable motor-mounting bases for belt-driven motors.
Align pulleys and install belts.
Tension belt according to manufacturer's written instructions.

3.4 DEMONSTRATION

Startup Services: Engage a factory-authorized service representative to perform startup services and to train Government's maintenance personnel as specified below:

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
Train Government's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
Review data in the maintenance manuals. Refer to Division 1 Section "General Requirements."
Schedule training with Government with at least 7 days' advance notice.

-- End of Section --

SECTION 08520

ALUMINUM WINDOWS

PART 1 GENERAL

1.1 WORK INCLUDED

Furnish and install aluminum architectural windows complete with hardware and related items as shown on Drawings and specified in this Section.

All windows shall be Custom Window TerroShield Series Blast Window System AW80 grade fixed, or awning window. Other manufactures requesting approval to bid their product as an equal must submit the following:

A sample window (size and configuration) as per requirements of architect.

Test reports documenting compliance with requirements of Section 1.5.

Glass and glazing:

All units are to be factory glazed.

Reference Section 08800 for Glass and Glazing.

Provide 6 addition 3 foot - 0 inch by 4 foot - 0 inch high windows for Fire Department to use for practice.

1.2 TESTING AND PERFORMANCE REQUIREMENTS

Test Units:

Air, water and structural test unit sizes and configuration shall conform to requirement set forth in AAMA 101-97.

Blast Resistance shall conform to UFC 4-010-01.

Test Procedures and Performance Standards:

Windows shall conform to all ANSI/AAMA 101-97, AW-80 requirements.

Air Infiltration Test:

With window sash and ventilators closed and locked, test unit in accordance with ASTM E 283 at static air pressure of 6.24 psf. Air infiltration shall not exceed .03 cfm per foot of perimeter crack length.

Water Resistance Test:

With window sash and ventilators closed and locked, test unit in accordance with ASTM E 331 at static pressure difference of 12.00 psf.

There shall be no uncontrolled water leakage.

Uniform Load Deflection Test:

With window sash and ventilators closed and locked, test unit in accordance with ASTM E 330 at a static air pressure difference (positive and negative) of 80 psf.

During the course of the test, no member shall deflect more than 1/175 of its span.

Uniform Load Structural Test:

With window sash and ventilators closed and locked, test unit in accordance with ASTM E 330 at a static air pressure difference of 120 psf.

At conclusion of test there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms, nor any other damage which would cause the window to be inoperable.

Life Cycle Test:

Tested in accordance with AAMA 910, there shall be no damage to fasteners, parts, support arms, activating mechanisms, or any other damage which would make the window inoperable. Subsequent air infiltration and water resistance tests shall not exceed specified requirements.

Condensation Resistance Test (CRF):

With window sash and ventilators closed and locked, test unit in accordance with AAMA 1502.7.

Condensation Resistance Factor (CRF) shall be not less than 60.

Thermal Transmittance Test (Conductive U-value):

With window sash and ventilators closed and locked, test unit in accordance with AAMA 1503.1.

Conductive thermal transmittance (u-value) shall be not more than .48 BTU/hr/sf/F0.

Blast Resistance:

Windows and frames shall meet requirements of UFC-4-010-01 for design and structural performance.

1.3 QUALITY ASSURANCE

Provide test reports from AAMA accredited laboratories certifying the performance as specified in 1.5.

Test reports shall be accompanied by the window manufacturer's letter of certification stating that the tested window meets or exceeds the referenced criteria for the appropriate ANSI/AAMA 101-97 window types.

Provide test reports or certified calculations showing the product meets the requirements of UFC 4-010-01 for the specific project application.

1.4 SUBMITTALS

SD-03 Product Data: Manufacturer's specifications, recommendations and standard details for window units.

SD-02 Shop Drawings: Include typical unit elevations, full- or half-scaled detail sections and typical installation details reviewed and approved by a professional engineer familiar with blast loads. Include type of glazing, screening, and window finish, size, and spacing of required fasteners.

SD-04 Finish Samples: Two samples of each required finish, on an extruded shape of aluminum sheet.

Samples: If required by Architect, submit samples showing fabrication techniques, workmanship of component parts, design of hardware, and other exposed auxiliary items.

1.5 DELIVERY, STORAGE, AND HANDLING

Store and handle windows and other components in strict compliance with manufacturer's instructions.

Protect units against damage from the elements, construction activities and other hazards before, during, and after installation.

1.6 WARRANTY

The responsible contractor shall assume full responsibility and warrant for one year the satisfactory performance of the total window installation which includes that of the windows, hardware, glass (including insulated units), glazing, anchorage and setting system, sealing, flashing, etc. as it relates to air, water and structural adequacy as called for in the specifications and approved shop drawings. Any deficiencies due to such elements not meeting the Specifications shall be corrected by the responsible Contractor at his/her expense during the warranty period.

PART 2 PRODUCTS

2.1 MATERIALS

Aluminum:

Extruded aluminum shall be 6063-T5 alloy and temper.

Hardware:

Projected Ventilators:

Butt hinges as specified, Anti-rotational cam locking handles, friction holdopens and/or limit stops.

Provide hardware of sufficient strength to withstand maximum blast pressure.

Weatherstrip:

All weatherstrip shall be Monsanto Santoprene or equal.

Glass and Glazing:

As specified in Section 08800 as calculated by a professional engineer.

Thermal Barrier:

Thermal barrier material shall be poured-in-place two part polyurethane, and shall be skip-debridged for structural integrity under blast loads.

Specified hardware shall not bridge the thermal barrier.

2.2 FABRICATION**General:**

Aluminum frame and sash extrusion shall have a nominal wall thickness of 0.125-inch.

Mechanical fasteners, welded components and hardware items shall not bridge thermal barriers. Thermal barriers shall align at all frame and sash corners.

Depth of frame and sash combined shall not be less than 3-1/4 inch.

Frame:

Frame components shall be mitered or butt jointed, as appropriate to the type of construction required. All joints shall be welded or incorporate mechanical fasteners.

Sash:

All sash extrusions shall be tubular.

Each corner shall be mitered and welded or reinforced with an extruded aluminum corner key, hydraulically crimped with an epoxy adhesive.

Each sash shall have two rows of Monsanto Santoprene weatherstripping installed in specially designed dovetail grooves in all four sides of the sash extrusion.

Screens:

Screen frames shall be extruded or roll formed aluminum.

Screen mounting holes in the window frames shall be factory drilled.

Screen mesh shall be aluminum or fiberglass.

Glazing:

Shop and Field glazed units are to be structurally glazed with silicone per recommendation by an engineer familiar with blast loads. Glass stops shall be mechanically applied with no exposed fasteners.

Finish:

Anodic:

Finish all exposed areas of aluminum windows and components with electrolytically deposited color in accordance with Aluminum Association Designation:

AA Description	Description	AAMA Guide Spec.
AA-M12-C22-A31/41 II/I	Clear Anod.	AAMA 607.1
AA-M12-C22-A34/44 II/I	Color Anod.	AAMA 608.1*

Color is to be dark bronze.

PART 3 EXECUTION

3.1 INSPECTION

Job Conditions:

Verify that openings are dimensionally within allowable tolerances, plumb, level, contain solid anchoring surfaces and are in accordance with approved Shop Drawings.

3.2 INSTALLATION

Done in accordance with structural calculations signed and stamped by an engineer familiar with blast loads.

Anchoring fasteners shall be installed in accordance with calculations signed and stamped by an engineer familiar with blast loads.

Use only skilled tradesman with work done in accordance with approved Shop Drawings and Specifications.

Plumb and align window faces in a single plane for each wall plane. Erect windows and materials square and true, adequately anchored to maintain positions permanently when subjected to normal thermal and building movement and specified wind loads.

Adjust windows for proper operation after installation.

Furnish and apply sealants to provide a weathertight installation at all joints and intersections and at opening perimeters. Wipe off excess material and leave all exposed surfaces and joints clean and smooth.

3.3 ADJUSTING AND CLEANING

After completion of window installation, windows shall be inspected, put into working order and left clean, free of labels, dirt, etc. Protection from this point shall be responsibility of General Contractor..

-- End of Section --

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SECTION 08711

DOOR HARDWARE (SCHEDULE BY NAMING PRODUCTS)

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

1.2.1 Section includes the following:

1.2.1.1 Commercial door hardware for the following:

Swinging doors.
Other doors to the extent indicated.

1.2.1.2 Cylinders for doors specified in other Sections.

1.2.1.3 Electrified door hardware.

1.2.2 Related Sections include the following:

1.2.2.1 Division 8 Section "Steel Doors and Frames" for astragals provided as part of a fire-rated labeled assembly and for door silencers provided as part of the frame..

1.2.2.2 Division 8 Section "Flush Wood Doors" for astragals provided as part of a fire-rated labeled assembly.

1.3 SUBMITTALS

1.3.1 Hi-lite all descriptive literature to accomplish identification of specific components/items which are proposed to be furnished. Government will not react to descriptive material/literature which has not been hi-lited, except to reject the Submittal.

1.3.2 SD-03 Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

1.3.3 Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1.3.3.1 Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

1.3.3.2 Organization: Organize the Door Hardware Schedule into door

hardware sets indicating complete designations of every item required for each door or opening.

Organize door hardware sets in same order as in the Door Hardware Schedule on Contract Drawings.

1.3.3.3 Content: Include the following information:

Type, style, function, size, label, hand, and finish of each door hardware item.

Manufacturer of each item.

Fastenings and other pertinent information.

Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.

Explanation of abbreviations, symbols, and codes contained in schedule.

Mounting locations for door hardware.

Door and frame sizes and materials.

Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.

1) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.

1.3.3.4 Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

1.3.3.5 Submittal Sequence: Submit initial draft of final schedule along with essential Product Data to facilitate the fabrication of other work that is critical in the Project construction schedule. Submit the final Door Hardware Schedule after Samples, Product Data, coordination with Shop Drawings of other work, delivery schedules, and similar information has been completed and accepted.

1.3.4 Keying Schedule: Prepared by or under the supervision of supplier, detailing Government's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

1.3.5 Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 1.

1.3.6 Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

1.4.1 Installer Qualifications: An experienced installer who has completed

door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1.4.2 Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Contracting Officer, and Government about door hardware and keying.

1.4.2.1 Scheduling Responsibility: Preparation of door hardware and keying schedules.

1.4.3 Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

1.4.4 Regulatory Requirements: Comply with provisions of the following:

1.4.4.1 NFPA 101: Comply with the following for means of egress doors:

Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.

Door Closers: Not more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.

Thresholds: Not more than 1/2 inch high.

1.4.5 Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1.4.5.1 Test Pressure: Test at atmospheric pressure.

1.4.6 Keying Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "General Requirements." Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1.4.6.1 Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.

1.4.6.2 Preliminary key system schematic diagram.

1.4.6.3 Requirements for key control system.

1.4.7 Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "General Requirements." Review methods and procedures related to electrified door hardware including, but not limited to, the following:

1.4.7.1 Inspect and discuss other preparatory work performed by other trades. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make

progress and avoid delays. Review required testing, inspecting, and certifying procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

1.5.2 Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

1.5.3 Deliver keys to Contracting Officer by registered mail.

1.6 COORDINATION

Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.7 WARRANTY

1.7.1 General Warranty: Special warranties specified in this Article shall not deprive Government of other rights Government may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1.7.2 Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

Structural failures including excessive deflection, cracking, or breakage.

Faulty operation of operators and door hardware.

Deterioration of metals, metal finishes, and other materials beyond normal weathering.

1.7.3 Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.

1.7.4 Warranty Period for Electromagnetic and Delayed-Egress Locks: Five years from date of Substantial Completion.

1.7.5 Warranty Period for Manual Closers: 10 years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Government's continued

adjustment, maintenance, and removal and replacement of door hardware.

Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

General: Provide door hardware for each door to comply with requirements in this Section, and the Door Hardware Schedule on Contract Drawings.

Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Schedule on Contract Drawings. Products are identified by using door hardware designations, as follows:

Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

2.2 HINGES AND PIVOTS

2.2.1 Manufacturers: Subject to compliance with requirements, provide products by one of the following or an equal approved by Contracting Officer:

2.2.1.1 Hinges:

Bommer Industries, Inc. (BI).

Hager Companies (HAG).

McKinney Products Company; Div. of ESSEX Industries, Inc. (MCK).

Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).

Stanley Commercial Hardware; Div. of The Stanley Works (STH).

2.2.1.2 Standards: Comply with the following:

Butts and Hinges: BHMA A156.1.

Template Hinge Dimensions: BHMA A156.7.

2.2.2 Quantity: Provide the following, unless otherwise indicated:

2.2.2.1 Two Hinges: For doors with heights up to 60 inches.

2.2.2.2 Three Hinges: For doors with heights 61 to 90 inches.

2.2.2.3 Four Hinges: For doors with heights 91 to 120 inches.

2.2.2.4 For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2.2.3 Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

Maximum Door Size (inches)	Hinge Height (inches)	Metal Thickness (inches)	
		Standard Weight	Heavy Weight
36 by 84 by 1-3/4	4-1/2	0.134	0.180
42 by 90 by 1-3/4	4-1/2	0.134	0.180
48 by 120 by 1-3/4	5	0.146	0.190

2.2.4 Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

2.2.5 Hinge Base Metal: Unless otherwise indicated, provide the following:

2.2.5.1 Exterior Hinges: Stainless steel, with stainless-steel pin.

2.2.5.2 Interior Hinges: Steel, with steel pin.

2.2.5.3 Hinges for Fire-Rated Assemblies: Steel, with steel pin.

2.2.6 Hinge Options: Comply with the following where indicated in the Door Hardware Schedule or on Drawings:

2.2.6.1 Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:

Outswinging exterior doors.

Outswinging corridor doors with locks.

2.2.6.2 Corners: Square.

2.2.7 Fasteners: Comply with the following:

2.2.7.1 Screws: Phillips flat-head screws; machine screws (drilled and tapped holes) for metal doors, wood screws for wood doors and frames. Finish screw heads to match surface of hinges.

2.3 LOCKS AND LATCHES

Manufacturers: Subject to compliance with requirements, provide products by one of the following or an equal approved by Contracting Officer:

Mechanical Locks and Latches:

Best Lock Corporation (BLC).

McKinney Products Company; Div. of ESSEX Industries, Inc. (MCK).

Medeco High Security Locks, Inc. (MED).

NT Falcon Lock Co.; an Ingersoll-Rand Company (NTF).

Schlage Lock Company; an Ingersoll-Rand Company (SCH).

Yale Security Inc.; Div. of Williams Holdings (YAL).

Standards: Comply with the following:

Bored Locks and Latches: BHMA A156.2.
Exit Locks: BHMA A156.5.

Bored Locks: BHMA Grade 1; Series 4000.

Certified Products: Provide door hardware listed in the following BHMA directories:

Mechanical Locks and Latches: BHMA's "Directory of Certified Locks & Latches."

Lock Trim: Comply with the following:

Lever: Wrought, forged, or cast.
Knob: Wrought, forged, or cast.
Escutcheon (Rose): Wrought, forged, or cast.
Dummy Trim: Match lever lock trim and escutcheons.

Lock Functions: Function numbers and descriptions indicated in the Door Hardware Schedule comply with the following:

Bored Locks: BHMA A156.2.

Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:

Bored Locks: Minimum 1/2-inch latchbolt throw.

Backset: 2-3/4 inches, unless otherwise indicated.

2.4 DOOR BOLTS

Manufacturers: Subject to compliance with requirements, provide products by one of the following or an equal approved by Contracting Officer:

Flush Bolts:

Glynn-Johnson; an Ingersoll-Rand Company (GJ).
Hager Companies (HAG).
Ives: H. B. Ives (IVS).
NT Quality Hardware; an Ingersoll-Rand Company (NTQ).

Standards: Comply with the following:

Manual Flush Bolts: BHMA A156.16.

Flush Bolts: BHMA Grade 1, designed for mortising into door edge.

Bolt Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:

Mortise Flush Bolts: Minimum 3/4-inch throw.

2.5 EXIT DEVICES

Manufacturers: Subject to compliance with requirements, provide products by one of the following or an equal approved by Contracting Officer:

Corbin Russwin Architectural Hardware; Div. of Yale Security Inc. (CR).
NT Dor-O-Matic Hardware Div.; an Ingersoll-Rand Company (NTD).
Von Duprin; an Ingersoll-Rand Company (VD).
Yale Security Inc.; Div. of Williams Holdings (YAL).

Standard: BHMA A156.3.

BHMA Grade: Grade 1.

Certified Products: Provide exit devices listed in BHMA's "Directory of Certified Exit Devices."

Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

Fire Exit Devices: Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

Outside Trim: Lever with cylinder; material and finish to match locksets, unless otherwise indicated.

Match design for locksets and latchsets, unless otherwise indicated.

2.6 CYLINDERS AND KEYING

Manufacturers: Subject to compliance with requirements, provide products by one of the following or an equal approved by Contracting Officer:

Cylinders: Same manufacturer as for locks and latches.
Key Control Systems:

Key Control Systems, Inc. (KCS).
Major Metalfab Co. (MM).
Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
Sunroc Corporation (SUN).

Standards: Comply with the following:

Cylinders: BHMA A156.5.
Key Control System: BHMA A156.5.

Cylinder Grade: BHMA Grade 1.

Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

Number of Pins: Seven.

Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.

Bored-Lock Type: Cylinders with tailpieces to suit locks.

High-Security Grade: BHMA Grade 1A, listed and labeled as complying with pick- and drill-resistant testing requirements of UL 437 (Suffix A).

Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

Interchangeable Cores: Core insert, removable by use of a special key, and usable with other manufacturers' cylinders.

Construction Keying: Comply with the following:

Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

Replace construction cores with permanent cores, as directed by Contracting Officer's Representative.

Keying System: Unless otherwise indicated, provide a factory-registered keying system complying with the following requirements:

Existing System: Master key or grand master key locks to Government's existing system.

Keys: Provide nickel-silver keys complying with the following:

Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

Notation: Information to be furnished by Government.

Quantity: In addition to one extra blank key for each lock, provide the following:

Cylinder Change Keys: Three.

Master Keys: Five.

Grand Master Keys: Five.

Great-Grand Master Keys: Five.

Key Control System: BHMA Grade 1 system, including key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers. Contain system in metal cabinet with baked-enamel finish.

Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

Capacity: Able to hold keys for 150 percent of the number of locks.

Cross-Index System: Set up by key control manufacturer, complying with

the following:

Computer Software: Furnish cross-index software for recording and reporting key-holder listings, tracking keys and lock and key history, and printing receipts for transactions. Include instruction manual.

2.7 STRIKES

Manufacturers: Subject to compliance with requirements, provide products by one of the following or an equal approved by Contracting Officer:

Standards: Comply with the following:

Strikes for Bored Locks and Latches: BHMA A156.2.
Dustproof Strikes: BHMA A156.16.

Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

Dustproof Strikes: BHMA Grade 1.

2.8 ACCESSORIES FOR PAIRS OF DOORS

Manufacturers: Subject to compliance with requirements, provide products by one of the following or an equal approved by Contracting Officer:

Astragals:

Hager Companies (HAG).
National Guard Products, Inc. (NGP).
Pemko Manufacturing Co., Inc. (PEM).

Standards: Comply with the following:

Coordinators: BHMA A156.3.

2.9 CLOSERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following or an equal approved by Contracting Officer:

Surface-Mounted Closers:

Corbin Russwin Architectural Hardware; Div. of Yale Security Inc. (CR).
LCN Closers; an Ingersoll-Rand Company (LCN).
Norton Door Controls; Div. of Yale Security Inc. (NDC).

Standards: Comply with the following:

Closers: BHMA A156.4.

Closer Holder Release Devices: BHMA A156.15.

Surface Closers: BHMA Grade 1.

Certified Products: Provide door closers listed in BHMA's "Directory of Certified Door Closers."

Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.10 PROTECTIVE TRIM UNITS

Manufacturers: Subject to compliance with requirements, provide products by one of the following or an equal approved by Contracting Officer:

Metal Protective Trim Units:

Hager Companies (HAG).

Ives: H. B. Ives (IVS).

NT Quality Hardware; an Ingersoll-Rand Company (NTQ).

Standard: Comply with BHMA A156.6.

Materials: Fabricate protection plates from the following:

Aluminum: 0.050 inch thick; beveled top and 2 sides.

Stainless Steel: 0.050 inch thick; beveled top and 2 sides.

Fasteners: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine or self-tapping screws.

Furnish protection plates sized 1-1/2 inches less than door width on push side and 1/2 inch less than door width on pull side, by height specified in Door Hardware Schedule.

2.11 STOPS AND HOLDERS

2.11.1 Manufacturers: Subject to compliance with requirements, provide products by one of the following or an equal approved by Contracting Officer:

Glynn-Johnson; an Ingersoll-Rand Company (GJ).

Hager Companies (HAG).

Ives: H. B. Ives (IVS).

NT Quality Hardware; an Ingersoll-Rand Company (NTQ).

2.11.2 Standards: Comply with the following:

Stops and Bumpers: BHMA A156.16.

Combination Overhead Holders and Stops: BHMA A156.8.

Door Silencers: BHMA A156.16.

2.11.3 Stops and Bumpers: BHMA Grade 1.

2.11.4 Combination Overhead Stops and Holders: BHMA Grade 1.

2.11.5 Floor Stops: For doors, unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic.

Where floor or wall stops are not appropriate, provide overhead holders.

2.11.6 Silencers for Metal Door Frames: BHMA Grade 1; neoprene or rubber, minimum diameter 1/2 inch; fabricated for drilled-in application to frame.

2.12 DOOR GASKETING

2.12.1 Manufacturers: Subject to compliance with requirements, provide products by one of the following or an equal approved by Contracting Officer:

Door Gasketing:

Hager Companies (HAG).
National Guard Products, Inc. (NGP).
Pemko Manufacturing Co., Inc. (PEM).

Door Bottoms:

Hager Companies (HAG).
National Guard Products, Inc. (NGP).
Pemko Manufacturing Co., Inc. (PEM).

2.12.2 Standard: Comply with BHMA A156.22.

2.12.3 General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

2.12.4 Air Leakage: Not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

2.12.5 Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.

Provide smoke-labeled gasketing on 20-minute-rated doors and on smoke-labeled doors.

2.12.6 Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL 10B or NFPA 252.

2.12.7 Gasketing Materials: Comply with ASTM D 2000 and AAMA 701/702.

2.13 THRESHOLDS

Manufacturers: Subject to compliance with requirements, provide products by one of the following or an equal approved by Contracting Officer:

Hager Companies (HAG).
National Guard Products, Inc. (NGP).
Pemko Manufacturing Co., Inc. (PEM).

Standard: Comply with BHMA A156.21.

2.14 FABRICATION

Manufacturer's Nameplate: Do not provide manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise approved by Contracting Officer.

Manufacturer's identification will be permitted on rim of lock cylinders only.

Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

Steel Machine or Wood Screws: For the following fire-rated applications:

Mortise hinges to doors.
Strike plates to frames.
Closers to doors and frames.

Steel Through Bolts: For the following fire-rated applications, unless door blocking is provided:

Closers to doors and frames.
Surface-mounted exit devices.

Spacers or Sex Bolts: For through bolting of hollow metal doors.
Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2,
"Recommended Fasteners for Wood Doors."

2.15 FINISHES

Standard: Comply with BHMA A156.18.

Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 EXAMINATION

Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

Steel Doors and Frames: Comply with DHI A115 series.

Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.

Wood Doors: Comply with DHI A115-W series.

3.3 INSTALLATION

Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or

required to comply with governing regulations:

Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections.

Do not install surface-mounted items until finishes have been completed on substrates involved.

Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.

Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

Key Control System: Place keys on markers and hooks in key control system cabinet, as determined by final keying schedule.

Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.4 FIELD QUALITY CONTROL

Independent Architectural Hardware Consultant: Government will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer shall perform the following:

Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware. Consult with and instruct Government's personnel on recommended maintenance procedures.

Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

3.6 CLEANING AND PROTECTION

Clean adjacent surfaces soiled by door hardware installation.

Clean operating items as necessary to restore proper function and finish.

Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

Engage a factory-authorized service representative to train Government's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

-- End of Section --

SECTION 08800

GLASS AND GLAZING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (1984; R 1994) Safety Glazing Materials
Used in Buildings

ASTM INTERNATIONAL (ASTM)

ASTM C 1036 (2001) Flat Glass

ASTM C 669 (2000) Glazing Compounds for Back Bedding
and Face Glazing of Metal Sash

ASTM C 920 (2002) Elastomeric Joint Sealants

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-04 Samples

Contractor shall submit the following samples:

Not less than 2 different samples 10 by 12 inches of each glass of the specified type, class, thickness, and finish shall be provide for inspection and approval by the Contracting Officer prior to delivery of material to site.

Color samples of each color and type of glazing and sealing compound to be used in the work, beads approximately 1/4-inch wide by 1 inch long, to illustrate the glazing or sealing compound manufacturer's standard color range after setting or curing.

Clear Glass
Heat Absorbing Glass
Safety Rated Tempered Glass
Clear Sheet Glass

Double Glazing Units
Elastic Glazing Compound
Elastomeric Sealing Compound

SD-07 Certificates

Certificates shall be submitted for the following items showing conformance with the referenced standards and tests contained in this section.

Glass Materials
Glazing Materials
Safety Rated Tempered Glass
Fire-Rated Wired Glass

1.3 DELIVERY, STORAGE AND HANDLING

Manufactured glass units shall be delivered and stored until installation in the manufacturer's container's and shall be clearly marked on the exterior as to type, and quantity of units.

When special moisture protection is required, glass shall be stored in accordance with the manufacturer's recommendations.

PART 2 PRODUCTS

2.1 GLASS MATERIALS

2.1.1 Clear Glass

Glass shall be float type conforming to ASTM C 1036, Type I, Class 1, Quality q3.

Maximum allowable areas of glass subject to wind pressure shall conform to the glass manufacturer's recommendations.

2.1.2 Heat-Absorbing Glass

Glass shall be float type conforming to ASTM C 1036, Type I, Class 2, Style A, Quality q3. Edges shall be factory.

Tint shall be bronze.

Maximum allowable areas of glass subject to wind pressure shall conform to the glass manufacturer's recommendations.

2.1.3 Safety-Rated Tempered Glass

Glass shall conform to ANSI Z97.1 and shall bear the ANSI safety glass marking.

Glass before tempering shall be the float type conforming to ASTM C 1036, Type I, Class 1, Quality q3.

Glass shall be factory-cut to suit each opening. Edges shall be clean cut.

2.1.4 Clear Sheet Glass

Glass shall conform to ASTM C 1036, Type II, Class 1.

Maximum allowable areas of glass subject to wind pressure shall conform to the glass manufacturer's recommendations.

Clear sheet glass shall be double strength.

2.1.5 Fire-Rated Wired Glass

Glass shall be UL approved for fire windows and doors, shall be listed in the UL Bld Mat Dir, Guide Designation KCMZ, and shall bear the UL listing and marking.

Polished wire glass shall conform to ASTM C 1036, Type II, Class 1, Form 1, Mesh m1.

Figured fire-rated glass shall conform to ASTM C 1036, Type II, Class 1, Form 2, Mesh m1 or m2.

2.1.6 Double-Glazing Units

Insulating Glass Unit Designation: Window Type C, D, and E.

Classification of Units: Class CBA per ASTM E 774.

Air Space Width: Nominal 1/2 inch measured perpendicularly from surfaces of glass lites at unit's edge.

Gas Filling: Fill air space with argon.

Sealing System: Manufacturer's standard sealants, polysulfide, polyurethane.

Spacer Specifications: Manufacturer's standard metal.

Desiccant: Either molecular sieve or silica gel or blend of both.

Corner Construction: Manufacturer's standard corner construction.

Glass Specifications: Comply with the following requirements:

Thickness of each Lite: 1 inch.

Laminated Indoor Lite: Class 1 (clear) float glass, complying with requirements specified for laminated glass products.

Low-Emissivity Coating: Pyrolytic on second surface.

Nominal Performance Characteristics are as indicated below:

Visible Light Transmittance: 53 percent.

Summer Daytime U-Value: 0.34.

Winter Nighttime U-Value: 0.30.

Shading Coefficient: 0.40.

Outdoor Visible Reflectance: 12 percent.

2.2 PLASTIC GLAZING

Plastic panels shall conform to ASTM D 3841 fire retardant.

2.3 GLAZING MATERIALS

2.3.1 Elastic Glazing Compound

Elastic glazing compound shall conform to ASTM C 669.

Color of the sealing compound shall match the color of the metal sash as closely as possible.

Unless otherwise specified, elastic glazing compound shall conform to ASTM C 920, Type S, Class 25, and shall be used for glazing-in metal. A glazing compound having a composition and color particularly adapted for aluminum and requiring no painting shall be used for glazing-in aluminum.

2.3.2 Thermoplastic Sealing Compound

Compound shall be one-component acrylic terpolymer base conforming to ASTM C 920. Compound shall match the color of the metal sash as closely as possible.

Sealants shall comply with Low Emitting requirements set forth in Section 01352.

2.3.3 Glazing Tape

Tape shall be nonskinning, nonoily, reinforced class, butyl- or polyisobutylene-base resilient preformed compound conforming to AAMA 800.

2.3.4 Elastomeric Sealing Compound

Compound shall be the two-component, nonsag type, resistant to 50 percent total joint movement, conforming to ASTM C 920, Type S, Class 25.

Compound shall match the color of the metal sash as closely as possible.

Primer for the compound shall be as recommended by the elastomeric sealing compound manufacturer.

Sealants shall comply with Low Emitting requirements set forth in Section 01352.

2.3.5 Wood-Sash Putty

Putty shall be the pure linseed oil type conforming to FS TT-P-00791, Type I.

2.3.6 Solvents and Cleaning Agents

Solvents, cleaning agents, and other cleaning materials shall be as recommended by the glazing-material manufacturer.

2.3.7 Glazing Clips

Clips shall be zinc-coated or copper-clad spring-steel wire or nonferrous metal and shall be the type, sizes, and shapes suitable for the intended use.

2.3.8 Resilient Setting Blocks and Spacers

Blocks shall be solid chloroprene elastomeric extrusions having a Shore A durometer hardness between 70 and 90. Thickness shall be approximately the same as the glass-edge clearance dimension; the length shall be 4 inches, minimum.

Spacers shall be solid chloroprene elastomeric extrusions having a Shore A durometer hardness between 40 and 50. Spacers shall be 2- to 3-inches long with thickness and height to suit the application.

PART 3 EXECUTION

3.1 GENERAL

Glass shall be installed in accordance with the manufacturer's printed instructions.

Field cutting, or nipping or grinding the edges of glass will not be permitted.

Sheet glass shall be installed with the wave horizontal.

Figured glass for exterior openings shall be installed with the smooth side to the exterior.

Operable sash shall move freely and properly in the frame of the unit prior to the start of glazing. Movable items shall be securely fixed or in a closed and locked position until the glazing material has set.

Sizes of glass shown on drawings are approximate. Sizes and proper edge clearances shall be determined by measuring the actual unit to receive glass. Except where specified otherwise, each piece of glass shall bear the manufacturer's label to identify its type as well as thickness and quality. Labels shall not be removed until final approval is obtained.

3.2 TEMPERATURE AND ATMOSPHERIC CONDITIONS

Glazing materials shall not be installed when the ambient temperature is below 40 or above 100 degrees F.

Exterior glazing shall not be performed in damp or rainy weather.

3.3 GLAZED OPENINGS PREPARATION

Surface of rabbets shall be clean and dry prior to the start of glazing.

Surfaces in contact with glazing materials shall be clean and free of loose particles, surface dust, and other foreign matter.

When elastomeric sealing compound is used, the surfaces shall be cleaned with a solvent that leaves no residue. Surfaces shall be wiped dry before the solvent has air dried.

3.4 CLEARANCES AND POSITIONING GLASS

Face and edge clearances and positioning glass with setting blocks and spacers shall be as recommended in the FGMA-01.

3.5 APPLICATION OF GLAZING COMPOUNDS

Glazing compounds shall be installed in accordance with the manufacturer's printed instructions and as follows:

Elastic glazing compound shall be knife-applied as it comes from the container, without adulteration.

Thermoplastic sealing compound shall be warmed. Compound shall be gun-applied to fill the cavity without air pockets.

3.6 SINGLE GLASS IN METAL SASH WITH CHANNEL GLAZING

Single-glass lights up to 100 united inches in size shall be set in metal sash with thermoplastic sealing-compound back bed, heel bead, and bedding of stop.

Single-glass lights shall be set in metal sash with glazing-tape back bed, elastomeric sealing-compound heel bead, glazing-tape bedding of stop, and elastomeric sealing-compound topping bead on both sides of the glass light. Glazing tape shall be kept down at least 1/8-inch below the sight line.

Clear-glass lights between 100 and 150 united inches in size shall be set with glazing-tape back bed, thermoplastic sealing-compound heel bead, glazing-tape bedding of stop, and thermoplastic sealing-compound topping bead on both sides of the glass light. Glazing tape shall be kept down at least 1/8-inch below the sight line.

Single-glass lights over 100 united inches in size shall be set with glazing tape-back bed, elastomeric sealing-compound heel bead, glazing-tape bedding of stop, and elastomeric sealing-compound topping bead on both sides of the glass light. Glazing tape shall be kept down at least 1/8-inch below the sight line.

Heat-absorbing glass lights over 100 united inches in size shall be set with glazing-tape back bed, elastomeric sealing-compound heel bead, glazing-tape bedding of stop, and elastomeric sealing-compound topping bead on both sides of the glass light. Glazing tape shall be kept down at least 1/8-inch below the sight line.

Tinted-glass lights over 100 united inches in size shall be set with glazing-tape back bed, elastomeric sealing-compound heel bead, glazing-tape bedding of stop, and elastomeric sealing-compound topping bead on both sides of the glass light. Glazing tape shall be kept down at least 1/8-inch below the sight line.

A void shall be provided at the head and jambs for clear-glass, wired-glass, and figured-glass lights over 100 united inches in size and for all heat-absorbing glass and tinted-glass lights.

Excess sealing compound on the sash shall be removed with a glazing knife at a slight angle over the sight line.

3.7 DOUBLE UNITS IN METAL SASH WITH CHANNEL GLAZING

Double-glazing units shall be set in metal sash with channel glazing in accordance with the recommendations of the FGMA-01.

A void shall be provided at the head and jambs. Excess elastomeric glazing compound on the sash shall be removed with a glazing knife at a slight angle over the sight line.

3.8 SINGLE GLASS IN ALUMINUM DOORS WITH FLUSH GLAZING

Single-glass lights shall be secured in aluminum doors with the door and frame manufacturer's preformed glazing gaskets and installed in accordance with the manufacturer's printed instructions. Lights shall be positioned with resilient setting blocks as specified.

3.9 GLASS PROTECTION

Glazed openings shall be identified during the construction period by tapes or flags that are not in contact with the glass.

Temporary labels shall be removed immediately after the glass and glazing work has been approved.

3.10 CLEANING

Upon completion of work, glass surfaces shall be cleaned and shall be free of glazing- or sealing-compound, smears, and other defacement.

-- End of Section --

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SECTION 08950

INSULATED TRANSLUCENT FIBERGLASS SANDWICH PANEL WALL SYSTEM

PART 1 GENERAL

1.1 SUMMARY

Section includes translucent fiberglass sandwich panel system for walls or skylights consisting of 2-3/4" thick flat (or curved) factory prefabricated into single units, (including factory installation).

Requests for substitutions must be approved in writing or by addendum no later than 10 days prior to bid date and in keeping with Division 1 of the specifications.

1.2 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.3 PERFORMANCE REQUIREMENTS

Deflection of entire system shall be no more than L/45, unless otherwise indicated.

Structural Loads: See structural sheets.

Air/Water Infiltration: For Water Penetration, curtainwall system shall be tested per procedures of ASTM E331, and shall show no water entry at WTP=10.00 psf, at 5.00 gph/ft. squared. Test shall be performed before and after uniform loads are applied. For Air Leakage, system shall be tested per procedures of ASTM E-283, and shall show results of no more than 0.01 cfm/ft. squared at 1.56 psf (25 mph) and 0.01 cfm/ft. squared at 6.24 psf (50 mph).

1.4 SUBMITTALS

SD-03 Product Data: Submit shop drawings and color samples of face sheets and finishes according to Div. 1.

SD-04 Samples: Submit product sample showing thickness, face sheets, colors and insulation 14" x 28".

SD-06 Test Reports: To be furnished by systems manufacturer in accord with Div.1, Submittals. The manufacturer shall submit certified test reports by an independent testing organization for each type and class of panel system. Reports shall verify that the material will meet all performance requirements of this specification. Previously completed test reports will be acceptable if by current manufacturer and indicative of products used on this project. Test reports required are:

Flame Spread and Smoke Developed (ASTM E-84 by UL 723)
Burn Extent (ASTM D-635)

Color Difference (ASTM D-2244)
Impact Strength (UL 972)
Tensile Bond Strength (ASTM C-297 after aging by ASTM D-1037)
Shear Bond Strength (ASTM D-1002) after 5 different aging conditions
Beam Bending Strength (ASTM E-72)
Insulation "U" Factor (by NFRC 100; ASTM C-236; E-1423 and C-1199)
NFRC Certification - Optional
Condensation Resistance Factor (AAMA 1503)
Class A Roof Covering Burning Brand (ASTM E-108)
Class A Roof System UL Listed (UL-790) - Optional
Class I Fire Approval (FM 4471) - Optional

Proof of regular, independent Quality Control Monitoring under a nationally recognized building code review and listing program shall be submitted.

Complete Energy and Structural Calculations and all above data must be submitted with any request to be included as an approved product to bid this section.

SD-12 LEED Submittals per Section 01352

1. Credit MR 4.1 and 4.2: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products containing recycled content.
 - a. Include statements indicating costs for products having recycled content.
2. Credit EQ 4.1: Submit manufacturer's product data for adhesives and sealants including printed statement of VOC content.
 - a. All interior adhesives and sealants shall comply with VOC limits set forth in Section 01352 "LEED Requirements."

1.5 QUALITY ASSURANCE

Installer Qualifications: Erection shall be by an installer which has been in the business of erecting and installing specified materials for at least five (5) consecutive years, and can show evidence of satisfactory completion of projects of similar size, scope and type.

Shop drawings to be reviewed and stamped by a registered engineer if required.

System manufacturer must be listed by a recognized building code authority, including the International Conference of Building Officials, which requires quality control inspections, and fire, structural and water infiltration testing by an approved agency for sandwich panel systems.

Quality control inspections; and required testing conducted at least once each year, shall include manufacturing facilities, sandwich panel components and production sandwich panels for conformance with "Acceptance Criteria for Sandwich Panels" as regulated by the ICBO-ES or equivalent.

Materials and products shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period

of at least ten (10) consecutive years and which can show evidence of these materials being satisfactorily used on at least six (6) projects of similar size, scope and type within such a period. At least three (3) projects shall have been in successful use for ten (10) years or longer.

Performance Requirement: The manufacturer shall be responsible for the configuration and fabrication of the complete panel system.

Product Options: Drawings indicated size, dimensions and profile to structural translucent panel system. Specifications indicate performance required. Other manufacturers that can meet portions of this specification and wish to be considered alternates must comply with Div. 1, Substitutions and Alternates, and can offer alternate bids for consideration using those guidelines.

1.6 PROJECT CONDITIONS

Field Measurements: Verify dimensions in system installation areas and indicate if dimensions on shop drawings are actual or guaranteed dimensions.

1.7 WARRANTY

General Warranty: Any warranties specified in this section shall not alter or change Owners rights and provisions received under other contract documents, and shall be in addition to those documents.

Special Warranty: System manufacturer shall provide written agreement to repair or replace all defective panel and system craftsmanship for a period of twenty (20) years, starting at date of delivery. Installer shall provide one (1) year warranty against leakage starting from date of installation completion.

1.8 PRODUCT HANDLING

Store panels on long edge, several inches above the ground, blocked and under cover to prevent damage. Follow manufacturer's storage and handling instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Kalwall Corporation - (800) 258-9777 (Basis for Design)
Muhler Company - (843) 572-9727
ARCO Plus - (888) 825-4872

Approved equal complying with design intent and all performance and material requirements.

2.2 MATERIALS - TRANSLUCENT FACE SHEETS - PANEL FABRICATION

Translucent fiberglass faces shall be manufactured from glass fiber reinforced thermoset resins by insulated system fabricator especially for

architectural use. Thermoplastic (e.g. polycarbonate, acrylic) faces are not acceptable.

FLAMMABILITY: The interior face sheet shall be UL listed and have a flamespread rating no greater than 50 (20) and smoke developed no greater than 250 (200) when tested in accordance with UL 723. Burn extent by ASTM D-635 shall be no greater than 1". Faces shall not deform, deflect, drip when subject to fire or flame, or become detached when subjected to 300 degrees F for 25 minutes.

WEATHERABILITY: The full thickness of the exterior face shall not change color more than 3.0 Hunter or CIE Units DELTA E by ASTM D-2244 after five (5) years outdoor South Florida weathering at 5 degrees facing South, determined by the average of at least three (3) white samples with and without a protective film or coating to ensure maximum, long-term color stability.

The exterior face shall have a permanent glass erosion barrier integrally embedded to provide maximum long-term resistance to fiber exposure. Sacrificial plastic surface films, coatings or veils not acceptable.

Exterior face sheet shall be smooth, .070" thick and crystal in color. Interior face sheet shall be .045" thick and crystal in color. Faces shall not vary more than +/- 10% in thickness, and be uniform in color.

Panel system shall be 2-3/4" thick, made of two (2) sheets of translucent fiberglass, bonded by heat and pressure to either an aluminum or composite grid core specifically for architectural use.

THERMAL INSULATION: Panels shall have a NFRC laboratory tested "U" factor of .53 thermally broken-flat only by ASTM C-236, E-1423 and C-1199. System shall be NFRC certified.

GRID CORES:

Grid pattern shall be nominal 12" x 12" shoji and symmetrical about the horizontal center line for each flat panel.

The thermally broken (aluminum) I-beam grid core shall be 6063 T6 or 6005 T5 with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 7/16". The I-beam grid shall be machined to tolerances of not greater than +/- .002". Thermal break shall be 1" minimum.

Panels shall withstand 1200 degrees F fire for minimum (1) hour without collapse or exterior flaming.

Thermally broken panels shall give minimum CRF (Condensed Resistance Factor) of 80 by AAMA 1503 measured on the grid line.

ADHESIVE:

The laminate adhesive shall be heat and pressure resin-type engineered for structural sandwich panel use, with minimum 25 years field use.

Adhesive shall pass testing requirements specified by the International Conference of Building Officials "Acceptance Criteria for Sandwich Panel Adhesive."

Minimum strength shall be 750 PSI tensile strength by ASTM C-297 after two (2) exposures to six (6) cycles each of the aging conditions prescribed by ASTM D-1037.

Shear strength by ASTM D-1002 minimum after exposures to five (5) separate aging conditions:

50% Relative Humidity at 73 degrees F: 540 PSI
182 degrees F: 100 PSI
Accelerated Aging by ASTM D-1037 at room temperature: 800 PSI
Accelerated Aging by ASTM D-1037 at 182 degrees F: 250 PSI
500-hour Oxygen Bomb by ASTM D-572: 1400 PSI

Impact Resistance: The exterior face sheet shall be uniform in strength, impenetrable by hand-held pencil and repel an impact equal to 60 (230) ft. lbs. without fracture or tear when impacted by 3-1/4" diameter, 5 lb. free-falling ball per UL 972.

Adhesive exposed to the interior space shall comply with the Low Emitting requirements set forth in Section 01352 "LEED Requirements."

Translucent structural sandwich panel shall be a true sandwich panel of flat fiberglass sheets bonded to a grid core of mechanically interlocking I-beams and shall be laminated under a controlled process of heat and pressure, and deflect no more than 1.9" at 30 psf in 10' by ASTM E-72.

The adhesive bonding line shall be straight, cover the entire width of the I-beam, and have a neat, sharp edge. In order to insure bonding strength, white spots at intersections of mutins and mullions shall not exceed 4 for each 40 sq. ft. of panel, nor shall they be more than 3/36" in width.

Panels and aluminum perimeter frame shall be pre-assembled where practical and sealed at the factory. Panels should be shipped to the job site in rugged shipping units, ready for erection.

PERIMETER CLOSURE SYSTEM, BATTENS AND ALUMINUM FINISHES:

Closure system shall be extruded 6063-T6 and 6063-T5 aluminum clamp-tite screw type. Curved closure system may be roll formed. (Thermal break system optional for walls.)

Aluminum closures to be supplied with 300 series stainless steel screws (excluding final fasteners to building) and shall be factory sealed to the panels. Aluminum battens and cap plates shall be field installed.

All exposed aluminum to be (mill) (architectural corrosion resistant finish which meets the performance requirements of AAMA 2604, color to be Federal Std. No. 37056.

Flexible sealing tape shall be manufacturer's standard pre-applied to

serrated edges of closure system at factory under controlled conditions.

PART 3 EXECUTION

3.1 EXAMINATION

Do not install systems until conditions adversely affecting installation and performance have been corrected.

3.2 PREPARATION

The general contractor shall prepare openings including isolating dissimilar materials from aluminum system which may cause damage by electrolysis, and shall provide temporary enclosures if required.

3.3 INSTALLATION

The installer shall erect translucent panel system in strict accordance with approved shop drawings as supplied by manufacturer, including fastening and sealing. All surfaces shall be cleaned before sealants are applied.

Secure non-moveable joints and accommodate thermal and mechanical movements.

If required, insure weep holes are correctly installed.

After other trades have completed work on adjacent material, inspect translucent panel installation and make any adjustments necessary to ensure proper installation and weather-tight conditions.

All staging and lifts required for the complete panel system installation and field measuring shall be provided by and maintained by the general contractor.

3.4 CLEANING

Clean panel system, both sides, after installation according to manufacturer's recommendations.

SECTION 09250

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 475	(2002) Joint Compound and Joint Tape for Finishing Gypsum Board
ASTM C 514	(2001) Nails for the Application of Gypsum Board
ASTM C 557	(2003) Adhesives for Fastening Gypsum Wallboard to Wood Framing
ASTM E 84	(2003) Surface Burning Characteristics of Building Materials

1.2 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.3 SYSTEM DESCRIPTION

Manufacturer's catalog data shall be submitted Special Framed Openings and Rated Wallboard Assemblies, meeting all design specifications as required by referenced standards within this section. Data shall include fire ratings, sound transmission classification, and permeance requirements where applicable.

Certificates shall be submitted for gypsum wallboard systems indicating that the proposed materials meet or exceed the project specifications and the listed reference specifications.

1.3.1 Partition Configurations

1.3.1.1 Single-Layer Partitions

Single-layer drywall partitions shall be fire-retardant gypsum wallboard, thickness as indicated.

1.3.2 Performance Requirements

1.3.2.1 Fire Retardant Requirements

Type X gypsum wallboard shall provide at least 1 hour fire-retardant rating for 5/8-inch thick material or 3/4-hour fire-retardant rating for 1/2-inch material when applied in single-layer, nailed on each face of load-bearing, wood framing members, and when tested in accordance with ASTM E 119.

When tested in accordance with ASTM E 84, gypsum wallboard shall have a maximum flame-spread rating of 15, fuel contributed 15, and smoke developed 15.

1.3.2.2 Ceiling Assembly Fire Ratings

Gypsum drywall ceiling and floor or roof assembly shall have a fire rating of 1 hour. Drywall construction shall be in accordance with the UL design and test as listed by the drywall manufacturer.

1.3.2.3 Permeance Requirements

Back gypsum wallboard shall meet the permeance requirements specified in ASTM C 36.

1.3.2.4 Sound Transmission Classifications

Sound transmission classification (STC) shall be as published by the gypsum wallboard manufacturer. Classifications shall be established in accordance with ASTM E 90 and shall reflect acoustical performance values obtained in laboratory tests by a recognized independent acoustical laboratory.

Gypsum drywall ceiling shall have an STC of 35 to 40.

1.4 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Fabrication drawings shall be submitted for the following items consisting of fabrication and assembly details to be performed in the factory.

- Hangers and Inserts
- Channels
- Resilient Channels
- Steel Stud Framing
- Metal Accessories
- Trim
- Suspension
- Furring

Installation drawings shall be submitted for gypsum wallboard

systems in accordance with paragraph entitled, "Erection, Installation, and Application," of this section.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items including fire ratings, sound transmission classification, and permeance requirements where applicable.

Gypsum Wallboard
Furring
Hangers and Inserts
Suspension
Channels
Resilient Channels
Joint Tapes
Compounds
Steel-Stud Framing
Metal-Framed Drywall Ceilings
Fasteners
Adhesives
Floor and Ceiling Runners

Manufacturer's catalog data shall be submitted for the following items in accordance with paragraphs entitled, "Framed Openings" and "System Description," of this section.

Special Framed Openings
Rated Wallboard Assemblies

SD-04 Samples

The following samples shall be submitted:

Gypsum Wallboard: Three full-size samples of each type.

Steel-Stud Framing: Three samples each, 8-inches long.

Fasteners: Three 12-inch square samples of each type of gypsum wallboard.

Trim: Three samples each, 8 inches long.

SD-07 Certificates

Certificates shall be submitted for gypsum wallboard systems in accordance with paragraph entitled, "System Description," of this section.

SD-12 LEED Submittals per Section 01352

1. Credit EQ 4.1: Submit manufacturer's product data for adhesives and sealants, including printed statement of VOC content.
 - a. All interior adhesives and sealants shall comply with VOC

limits set forth in Section 01352 "LEED Requirements."

2. Credit MR 4.1 and 4.2: Product data indicating percentage by weight of post-consumer and post-industrial recycled content for products having recycled content.

a. Include statement indicating cost of each product having recycled content.

3. Credit MR 5.1 and 5.2: Submit invoices and documentation showing manufacturing locations for all products manufactured within 500 miles of the project site.

a. Include statement indicating cost of each product manufactured within 500 miles of project site.

b. Include statements indicating locations of extraction, harvest, or recovery of product components within 500 miles of project site.

1.5 DELIVERY, HANDLING, AND STORAGE

Materials shall be protected from weather, soil, and damage during delivery, while stored, and during construction.

Materials shall be delivered in the manufacturer's original packages; containers or bundles shall bear the brand name and the name of the manufacturer.

Materials shall be stored in dry, weathertight, and properly ventilated areas.

Gypsum wallboard shall be neatly stacked flat, with care taken to avoid sagging or damage to edges, ends, and surfaces.

Wallboard delivered to the building shall be kept protected and banded with midpoint slat spaces of 2 by 1/2-inch material extended full width between each layer of gypsum wallboard.

1.6 PROJECT/SITE CONDITIONS

1.6.1 Environmental Requirements

1.6.1.1 Temperature

A temperature of not less than 55 degrees F shall be provided in areas of work during the application of the materials and shall be maintained until the joint treatment compounds are dry.

1.6.1.2 Ventilation

Ventilation shall be provided to eliminate moisture within the building.

1.6.1.3 Moisture Control

Gypsum wallboard installation and joint treatment shall be accomplished in a uniform temperature with sufficient ventilation to ensure that throughout the application period the wallboard moisture does not exceed 8 percent.

Wallboard that has a moisture content in excess of 8 percent shall not be installed.

1.6.2 Field Measurements

Field measurements shall be taken before installation of materials to verify the indicated dimensions and to ensure proper fit of the work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Gypsum board manufacturing plant to be located within 500 miles of the project site.

GP Gypsum - 2120 Lane 16-1/2, Lovell, Wyoming (307) 548-2283, or equal.

Gypsum board to contain recycled material.

2.2 WALLBOARD MATERIALS

2.2.1 General Requirements for Wallboard

Gypsum wallboard shall conform to ASTM C 36 of grade and form as specified for each type of board. Wallboard shall be 48-inches wide, shall have thickness as indicated, and a maximum practical length for end use.

2.2.2 Ceiling

Board for drywall ceilings shall be 5/8-inch thick, fire-retardant gypsum wallboard.

2.2.3 Fire-Retardant Gypsum Wallboard

Fire-retardant gypsum wallboard shall be Grade X, Form a, at least 5/8 inch thick.

2.2.4 Gypsum Backing Board

Gypsum backing board shall conform to ASTM C 442 and shall be at least 1/2-inch thick when used as the first ply of a two-ply application, 48-inches wide, and in maximum practical length for end use.

2.2.5 Water-Resistant Backing Board

Backing board for use with ceramic tile or other nonabsorbent wall tiles shall be moisture-resistant and thickness as indicated and shall meet the requirements of water resistance of ASTM C 630 when tested in accordance with ASTM C 473.

2.2.6 Joint Materials

2.2.6.1 Joint Tapes

Joint tape shall be plain or perforated material conforming to ASTM C 475, Type II, Styles 1 and 2.

2.2.6.2 Compounds and Adhesives

Joint compound shall be an adhesive, without fillers, conforming to ASTM C 475, Type I, Style 1.

Laminating adhesive shall be joint compound of the type used for embedding tape or a material recommended by the manufacturer of the gypsum board. Ready-mixed joint compound (Style 3) shall not be used as laminating adhesive.

Adhesive for fastening gypsum wallboard to wood framing shall conform to ASTM C 557 and Section 01352 "LEED Requirements."

2.2.7 Metal Fasteners

Nails shall be steel, diamond point, with mechanically deformed shank, and shall conform to ASTM C 515.

Screws shall be steel, self-tapping drywall type, bugle head, self-drilling point; the length shall be as recommended by the drywall manufacturer for the type of system being installed.

Screws for anchorage of runner channels to studs and securing gypsum backing board to metal studs and furring channels shall be 1 inch long. Screws for temporary support of gypsum wallboard face ply shall be 1-5/8-inches long of the same type.

Bolts shall be steel and conform to ASME B18.2.1. Type II, regular hexagon bolts.

Nuts shall be steel, plain, hexagon, Type II, and shall conform to ASME B18.2.2.

Expansion shields shall conform to ASTM C 514, Group, Type, and Class as required.

Staples shall conform to ASTM C 514, galvanized steel, Table IV-A, size as required.

Wire for tying insulation shall be galvanized soft steel wire conforming to ASTM A 641/A 641M, steel number 1010, Class 1 light zinc coating.

2.2.8 Metal Framing Materials

2.2.8.1 Hangers and Inserts

Wire hangers for main runner channels shall be galvanized soft steel wire not less than 28-gage, conforming to ASTM A 641/A 641M, steel number 1010, Class 2 zinc coating.

Hot-dip galvanized flat steel hangers 1 by 3/16 inch; galvanized concrete

insert-type rod hangers may be substituted for wire hangers.

Tie wires for splicing furring channels or for securing furring channels to main running channels shall be galvanized soft steel wire not less than 16-gage with Class 2 zinc coating.

Clips used in lieu of tie wire shall be galvanized steel equivalent in holding power to that provided by the tie wires and of a type recommended by the gypsum board manufacturer.

2.2.8.2 Suspension, Furring, and Channels

Channels shall be formed from galvanized steel sheets conforming to SMACNA ASMM, Type I, Class d, ordinary zinc coated (commercial).

Main runner channels shall be 1-1/2-inch, hot- or cold-rolled, galvanized steel. Hot-rolled channels shall weigh not less than 1.12 pounds per linear foot. Cold-rolled channels shall be not less than 16-gage uncoated steel with flanges at least 19/32-inch wide.

Furring channels shall be roll-formed, galvanized steel not less than 0.021 inch thick before galvanizing, with steel face width of 1-3/8 inches and a depth of 7/8 inch, and shall have reinforced, folded edges.

Furring channels for miscellaneous framing shall be 3/4-inch wide, cold-rolled galvanized steel not less than 16-gage before galvanizing, and shall weigh not less than 0.33 pounds per linear feet.

Nailing channels 3/4 by 7/8 inch shall be cold-rolled, electrogalvanized steel not less than 25-gage before galvanizing, and shall be formed with a continuous lip to retain ratchet nail fasteners.

2.2.8.3 Resilient Channels

Resilient channels shall be formed from cold-rolled, electrogalvanized steel, shall have a minimum thickness of 26-gage in a modified hat section with a face width of 1-1/2 inches, and shall have a depth of 1/2 inch, with reinforced flange edge and prepunched holes in flange for screw fastening.

2.2.8.4 Steel-Stud Framing

Steel studs, floor and ceiling runners, angle runners, and furring channels shall be electrogalvanized, cold-rolled steel conforming to ASTM C 645 ordinary zinc coated (commercial).

Metal studs shall be formed, zinc-coated sections of channel or Z-shape, of 26-gage minimum thickness, and of widths indicated on the drawings. Stud flanges that come in contact with gypsum wallboard shall be a minimum of 1-1/4 inches wide, with a 1/4-inch stiffening lip with turned or folded edges. Holes shall be regularly punched in studs to facilitate installation of electrical wiring, conduit, or horizontal bracing.

Floor and ceiling runners shall be not less than 26-gage steel before galvanizing, with 1-1/4-inch flanges, sized to nest with steel stud.

Angle runners shall be 1-3/8 inches by 7/8 inch and not less than 22-gage.

2.2.9 Metal Accessories and Trim

2.2.9.1 Corner Beads and Trim

Corner beads shall be 30-gage minimum, hot-dip galvanized steel, with 1-1/4- by 1-1/4-inch flanges and a 1/8-inch beaded corner.

Corner beads shall be formed to an angle of 90 degrees and shall be zinc-coated steel not lighter than 30-gage before coating with wings not less than 7/8-inch wide and perforated for nails and cement treatment.

Casing trim shall be 28-gage nominal thickness, hot-dip galvanized steel channel, depth as required for wallboard, with attached tape flange.

2.2.9.2 Metal Base

Metal base shall be fabricated from hot-rolled strip steel, commercial quality, in accordance with ASTM A 569/A 569M and shall be 2-1/2-inches wide, (18-gage), flush face or reveal face as indicated, factory primed with manufacturer's standard rust-inhibiting primer, with welded exterior corners, splice, and attachment plates.

2.2.10 Control Joint Material

Control joint material shall be one piece, 29-gage, roll-formed zinc, formed 7/16-inch deep by 1/4-inch wide with a perforated flange 7/8-inch wide on each side of the joint opening, with a protective plastic strip.

2.2.11 Calking

Control joint calking shall be as recommended by the drywall manufacturer and shall be the same type used for partition and ceiling assemblies when the fire rating and STC were established.

2.2.12 Dust Membrane

Dust membrane shall be clear, 4-mil polyethylene film, conforming to ASTM D 2103, Type 13000.

2.2.13 Fire-Insulation Blankets

Insulation shall be semirigid, paperless, spun mineral-fiber mat, thickness and width as indicated, and shall conform to ASTM C 553. Material shall be UL listed with a Class A fire-hazard classification as defined in NFPA 101; flame spread shall not exceed 25, fuel distributed 20, smoke developed 0 when tested in accordance with the tunnel test of ASTM E 84.

2.3 SOURCE QUALITY CONTROL

Gypsum wallboard shall be tested at the manufacturing plant in accordance with ASTM C 473 for flexural strength, thickness and weight of paper and

predecorated board surfacing, and thickness of edge of recessed or tapered-edge gypsum wallboard.

PART 3 EXECUTION

3.1 PREPARATION

Defective wall and ceiling surfaces shall be corrected prior to application of drywall materials.

3.2 ERECTION, INSTALLATION, AND APPLICATION

3.2.1 Framing

Framing members to receive gypsum wallboard shall be straight, plumb, and true and spaced not to exceed the maximum spacings for the board thickness.

3.2.2 Board Length

Boards of maximum practical length shall be used to minimize the number of end joints. Edges of boards shall be butted together but shall not be forced.

3.2.3 Staggering Boards

Joints shall be staggered and shall not be aligned with the edge of an opening nor positioned so that the corners of four boards will meet at a common point.

3.2.4 Joints

All abutting ends or edge joints shall occur over solid bearing, (wood joists, wood furring, or over the web surface of furring channels) and shall be fitted neatly and accurately, with all end joints staggered. Wallboard shall be supported as recommended by the manufacturer, with additional framing at all cutouts and openings.

3.2.5 Ceiling Abuts Dissimilar Wall

Perimeter of ceilings shall be finished with an edge bead trim where ceiling abuts dissimilar wall materials.

3.2.6 Wall Trim

Trim shall be applied to wall and accurately aligned with the finished ceiling. Ceiling board edges that adjoin walls shall be laid on the horizontal leg of the trim strip, and the space behind the junction shall be closed with a dust membrane. Membrane shall be applied in advance of the wallboard application.

3.2.7 Corners and Edges

Exposed corners and edges and the perimeter of door, window, and borrowed-light frames shall be finished with the specified metal trim.

3.2.8 Tolerance and Alignment

Finished wallboard application shall be plumb and true, with all joints aligned to within a 1/16-inch tolerance and with all surfaces shimmed and aligned to a plane and even surface having a maximum variation of 1/8 inch in 8 feet.

3.2.9 Midheight Horizontal Bracing

Midheight horizontal bracing shall be continuous in partitions for all heights above 8 feet 6 inches. Bracing shall be standard runner channel for stud size specified. Channel shall be secured rigidly in place at each stud.

3.2.10 Partition Bracing

Where gypsum wallboard partitions do not extend to the underside of construction above, they shall be braced at the top channel with a V-frame perpendicular to the line of the partition located 18 feet 8 inches maximum on center where partitioning is not intersected or otherwise braced. V-braces shall be composed of two 2-by 2-by 1/8-inch angles attached to metal clips. When brace is in final position, it shall be welded, or holes shall be drilled and the brace bolted in permanent position. Partitions shall not exceed 16 feet in height.

3.2.11 Ply

Wallboard shall be applied to ceilings in single-ply, with the long dimension of the wallboard at right angle to the furring members as specified herein and in accordance with the drywall manufacturer's instructions for the type and classification of wall assembly indicated.

3.2.12 Fastening

Board shall be fastened with power-driven, phillips-head screws at a maximum spacing of 12 inches on center in the field of the board and at 8 inches on center at edges and along abutting ends, nails at a maximum spacing of 6 inches on center.

Screws shall be placed not closer than 3/8 inch to ends or edges of boards.

3.2.13 Installation of Control Joints

Control joints shall be provided where indicated and shall be screwed in place.

3.2.13.1 Ceiling

Ceiling control joints fastened securely in place shall be provided at spacing not to exceed 50 feet in each direction.

3.2.13.2 Vertical

Vertical control joints in long runs of drywall partitions shall be provided at spacing not to exceed 30 feet on center; at partition intersections with structural floors and columns; and at walls of dissimilar materials.

3.2.13.3 Abutting Concrete Slabs

Where tops of drywall partitions abut concrete slab floors, a 1/2 inch gap for deflection shall be provided between the top of stud and bottom of floor slab. A double slip track consisting of an inside and outside deep leg track shall be provided with studs screwed to the inside track. Runner tracks shall be embedded in calking or in an adhesive recommended by the drywall manufacturer, then stub-nailed in place.

3.2.14 Trim

Edges of exposed drywall shall be trimmed with the specified metal bead.

3.2.15 Fire-Insulation Blankets Application

Insulation shall be securely stapled to wood framing members and wired to steel members in accordance with the gypsum wallboard manufacturer's written instructions.

3.2.16 Framed Openings

Support members shall be provided at ceiling openings as required for access panels, recessed lighting fixtures, and heating and ventilating ducts.

3.2.17 Joint Finishing

Joints between wallboard panels and joints at metal trim shall be reinforced with joint tape and embedding-type joint compound and concealed with at least two applications of finishing compound in accordance with the printed instructions of the manufacturer of the gypsum wallboard. Screw depressions shall be filled with at least three coats of joint compound. Flanges at corner beads, edge trim, and control joints shall be concealed with at least two applications of joint compound, feathered and sanded smooth.

3.2.18 Moisture Proofing

Edges of gypsum wallboard adjoining tile bases and cut edges in areas of high humidity shall be sealed before erection with a waterproofing agent, plastic tape, joint compound, or material approved by the manufacturer of the wallboard.

3.2.19 Installation of Gypsum Drywall Ceilings

3.2.19.1 Metal-Framed Drywall Ceilings

Metal-framed drywall ceilings shall be installed and finished as specified and in accordance with the drywall manufacturer's written instructions for

drywall ceilings installed over suspended or furred metal grilles and as required for the indicated fire rating and STC.

3.2.19.2 Metal Suspension Grilles

Main runner channels suspended or furred from the bottom chord of steel joists shall have the wire hanger looped around the runner channel and twisted a minimum of three times around itself. Hangers shall be plumb and spaced at not more than 4 feet on center.

Main runner channels shall be spliced with 12-inch nested laps and tied securely near each end of the splice with two loops of 8-gage hanger wire. Splices shall be staggered.

Furring channels or resilient channels shall be installed at right angles to main runner channels or structural supporting members, and shall be fastened with clips or tie wires at a maximum spacing of 48 inches on center. Resilient channels shall be screw fastened to wood members. Furring channels or resilient channels shall be spaced at 24 inches on center. Channels shall be extended to within 2 inches of perimeter walls and abutting elements. Channels shall not be anchored or buried in the wall.

3.2.20 Steel Stud Framing

Floor and ceiling runner tracks shall be accurately aligned and securely attached to floors, structural ceilings, finished ceilings, or roof deck. Track shall be attached to concrete slabs with anchors at 24 inches on center; track shall be attached to metal ceiling grilles with a double strand of 18-gage tie wire spaced at no more than 16 inches on center.

Runners shall extend beyond open-end partitions for at least 12 inches. Upon installation of end studs, runner extensions shall be bent and nested with the stud and attached with at least two sheet metal screws.

Runners shall be furnished in longest practical lengths with butt joints.

Steel studs shall be size indicated, spaced at 24 inches on center. A maximum height span of 12 feet shall be used for 2-1/2-inch studs. Maximum height span for 3-5/8-inch studs shall be 16 feet.

Studs for pipe chases, ventilating shaft framing, and steel column or beam fireproofing shall be the size indicated, spaced 16 inches on center.

Studs shall be positioned plumb in ceiling and floor runners and attached with at least one self-tapping screw on each side of the stud ends. Studs shall be installed in continuous lengths with no splicing.

Stud shall be placed no more than 1/2 inch from door frames, framed openings, abutting partitions, and partition corners. Studs shall be securely anchored direct or with spacers to door and borrowed-light frames by screw attachment.

Top-runner channels of intersecting partitions shall have the web extended

across the intersected channel. Extended web shall be fastened with two screws. Flanges of the intersecting channel shall be cut, bent, and fastened to the flanges of the continuously intersected channel with two screws in each flange.

Partition reinforcement shall be provided over door and borrowed-light frame openings and, where required, for support of plumbing fixtures, accessories, and electrical and mechanical equipment. Reinforcement shall consist of cut-to-length sections of runner track or cold-rolled channels extending at least 2 feet on each side of the opening and braced and fastened to studs in accordance with the manufacturer's directions.

Head and jamb framing at door openings shall consist of a tube made up of one runner channel and one stud. Tubes at door jambs shall extend the full height of the partition and shall be fastened together with screws at a minimum of 24 inches center-to-center each flange. Tube over the door head shall be fastened together with a minimum of three screws each flange. Runner channel section of the header tube shall be cut 12-inches longer than the span between the two jamb studs. A web bend shall be made with 6 inches extended in a vertical direction on each jamb tube and fastened with a minimum of two screws. Flanges shall be extended horizontally and fastened to the flanges of the vertical stud. Cut-to-length studs shall then be positioned at not more than 16-inch spacing over the door opening and secured to the tube with a web flange bend with a minimum of two screws. Runner channel sections of tubes shall be secured to the door frame head and jamb with two 1/4-inch machine bolts, nuts, and washers.

3.2.21 Fixture Attachment

Metal mounting strips shall be provided for cabinets and shelving as indicated. Mounting strip shall be braced and secured between studs; attachment bolts that extend through bracing, studs, and drywall shall be provided.

3.2.22 Double Partition Steel Stud Framing

Double partition stud framing shall consist of two completely separate steel stud partitions with stud width and spacing as indicated. Stud partition shall be constructed as specified herein and in accordance with gypsum wallboard manufacturer's written instructions.

Insulation shall be of thickness indicated and shall be woven through alternating studs in each partition line, and shall be fastened securely to each stud.

3.2.23 Steel Framed Drywall Partitions

3.2.23.1 Single-Layer Partition Over Steel Framing

Gypsum wallboard shall be applied and finished as specified and in accordance with the drywall manufacturer's written instructions for a UL-approved, 1-hour fire-rated, single-layer, screw-stud drywall partition, with an STC of at least 41. All perimeter joints shall be calked.

3.2.23.2 Metal Furring

Furring to receive gypsum wallboard shall be the specified galvanized-steel furring channels of the type and spacing as indicated. Clips and fasteners shall be provided as required for type of installation and in accordance with the wallboard manufacturer's written instructions. Furring members shall be installed plumb and true, shimmed to a plane surface, and spaced as indicated. Plane surface shall vary less than 1/8 inch in 8 feet.

3.2.24 Structural Frame Fireproofing

3.2.24.1 Column Fireproofing

Steel columns shall be fireproofed with two layers of 5/8-inch thick, Grade X, fire-retardant, gypsum wallboard, laminated and wired to column and furring as indicated and in accordance with the gypsum wallboard manufacturer's written instructions for a UL-approved, 2-hour fire-rated construction. Wallboard shall be attached to 1-5/8-inch steel studs located at each corner of the columns. Joints shall be finished. Exposed corners and edges shall be finished with metal corner beads as specified.

3.2.25 Surface Finishing

Surface defects and damage shall be corrected to leave wallboard smooth, uniform in appearance, and ready to receive finish as specified in other sections of these specifications.

All control joints shall be properly and completely filled with the specified sealant.

Joints shall be sanded when dry after each application of joint compound. Final finish shall be uniformly smooth and flush with the paper face of the wallboard.

Surfaces of the work, and adjacent surfaces soiled as a result of this work shall be cleaned.

-- End of Section --

SECTION 09310

CERAMIC TILE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|-------------|---|
| ANSI A108.1 | (1999) Installation of Ceramic Tile, A Collection |
| ANSI A136.1 | (2000) Organic Adhesives for Installation of Ceramic Tile |
| ANSI A137.1 | (1988) Ceramic Tile |

ASTM INTERNATIONAL (ASTM)

- | | |
|-------------|--|
| ASTM A 185 | (2002) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete |
| ASTM C 144 | (2003) Standard Specification for Aggregate for Masonry Mortar |
| ASTM C 150 | (2002a ¹) Standard Specification for Portland Cement |
| ASTM C 171 | (2003) Standard Specification for Sheet Materials for Curing Concrete |
| ASTM C 206 | (2003) Standard Specification for Finishing Hydrated Lime |
| ASTM C 207 | (2004) Standard Specification for Hydrated Lime for Masonry Purposes |
| ASTM C 648 | (1998) Standard Test Method for Breaking Strength of Ceramic Tile |
| ASTM D 2103 | (2003) Standard Specification for Polyethylene Film and Sheeting |

1.2 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

- Wall Tile
- Ceramic Tile Trim
- Ceramic Floor Tile
- Mortar
- Grout Materials
- Membrane Materials
- Metal Reinforcement Materials

SD-04 Samples

Manufacturer's Standard Color Charts shall be submitted for ceramic tile in accordance with paragraph entitled, "Materials," of this section.

2 full-size samples of each type, color and pattern of Wall Tile, Ceramic Floor Tile, and Ceramic Tile Trim.

SD-07 Certificates

Certificates shall be submitted for the following items showing conformance with the referenced standards contained in this section.

- Wall Tile
- Ceramic Tile Trim
- Ceramic Floor Tile
- Mortar
- Grout Materials
- Membrane Materials
- Metal Reinforcement Materials

SD-12 LEED Submittals per Section 01352

1. Credit EQ 4.1: Manufacturer's product data for adhesives and sealants, including a printed statement of VOC content.
2. Credit MR 4.1 and 4.2: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products containing recycled content.
 - a. Include statements indicating costs for products having recycled content.

PART 2 PRODUCTS

2.1 MATERIALS (for design purposes ceramic tile was picked and is located on Sheet A5.1).

Manufacturer's Standard Color Charts shall be submitted for ceramic tile showing the manufacturer's recommended color and finish selections.

2.1.1 Grout Materials

Grout for glazed wall and ceramic mosaic tile shall be a commercial portland cement grout mixture conforming to ANSI A108.1.

2.1.2 Membrane Materials

Waterproofing membrane shall be 4-mil polyethylene film conforming to ASTM D 2103.

2.1.3 Metal Reinforcement Materials

2.1.3.1 Welded Wire Fabric

Reinforcing for mortar bed shall be plain, cold-drawn welded steel wire conforming to ASTM A 185, in 2 by 2 inch by No. 16 U.S. steel wire gage (AWG).

2.1.3.2 Metal Lath

Expanded-steel lath shall be painted, self-furring, shall weigh not less than 2.5 pounds per square yard, and shall conform to ANSI A108.1.

2.2 COMPONENTS

2.2.1 Tile

2.2.1.1 Wall Tile

Standard grade, bright glazed units conforming to ANSI A137.1 shall be not less than 5/16 inch thick; cushion edge; with spacer lug construction.

Wall tile to be made from at least 50% recycled glass.

Wall tile shall have nominal face dimensions as follows:

4-1/4 by 4-1/4 inch

2.2.1.2 Ceramic Floor Tile

Standard grade, unglazed, impervious porcelain-type ceramic mosaic tile shall conform to ANSI A137.1. Water absorption shall not exceed 0.5 percent. Tile shall be nominal 1/4-inch thick; cushion edge; factory mounted on sheets.

Floor tile to be made from at least 50% unfired raw materials that are reclaimed from the tile manufacturing process.

Floor tile shall have nominal face dimensions as follows:

12 by 12 inch

Floor Tile Characteristics are outlined in ANSI A137.1 and are the same as wall tile except:

The range of major thickness in a sample lot shall not exceed 0.040 inch using ASTM C 499. Average breaking strength shall be 250 pounds force or greater as per ASTM C 648.

2.3 ACCESSORIES

2.3.1 Ceramic Tile Trim

Trim shall be of the same material as ceramic wall tile and shall conform to ANSI A137.1.

According to ASTM C 499, thickness shall be measured on flat portions 1/2 inch from the edges. Range of major thickness is not to exceed 0.031 inch for wall tile grim and 0.040 inch for floor tile trim. The average reported thickness shall be within 0.02 inch of the average reported wall or floor tile average thickness.

Trim shapes shall be provided at external and internal corners; at head, jamb, and sills of openings; and as follows:

Base trim shall consist of sanitary cove units.

Trim at top of surface mounted tile wainscots shall be surface bull nose shapes.

External corner trim shall be cap shapes.

Internal corner trim shall be cap shapes of square corner, combination angle, and stretcher type.

2.4 MIXES

2.4.1 Setting and Grouting Materials

All setting and grouting materials to meet ANSI 118.3 with a VOC content of 65 g/L or less when calculated according to CFR 59, Subpart D (EPA Method 24).

2.4.2 Portland Cement Mortar

Cement shall conform to ASTM C 150, Type I.

Aggregate shall be washed, sharp, uncoated natural sand conforming to ASTM C 144. Aggregate used shall be so graded that not less than 100 percent of the aggregate passes a No. 8 sieve, and 95 percent of the aggregate passes a No. 16 sieve.

Lime shall conform to ASTM C 206 and ASTM C 207, Type S.

Water shall be potable.

Mortar shall conform to ANSI A108.1.

2.4.3 Dry-Set Portland Cement Mortar

Mortar shall conform to ANSI A108.1.

2.4.4 Organic Adhesive Mortar

Mortar shall conform to ANSI A136.1, Type I.

PART 3 EXECUTION

3.1 PREPARATION

Before commencing work, field pattern and border line locations shall be established and the work shall be centered symmetrically so that no tile need be cut to less than half size. Joints in wall tile shall be aligned vertically and horizontally; staggered joints will not be accepted.

3.1.1 Protection

Tile and areas to receive tile shall be maintained at a minimum temperature of 60 degrees F for not less than 2 calendar days before starting work and not less than 3 calendar days after completion.

3.1.2 Covering Tile Floors

Tile floors shall be covered, after grouting and cleaning, with kraft paper or polyethylene-curing covers conforming to ASTM C 171. Adjoining sheets shall be side-lapped not less than 6 inches. End laps shall be not less than 12 inches. Cement or tape joints to form a continuous membrane.

Floor covers shall be maintained in good condition.

3.2 INSTALLATION

Printed instructions of manufacturer's of commercial mortars and grouts shall be followed.

3.3 FIELD QUALITY CONTROL

3.3.1 Tests

Finished tile installation shall display no uneven surfaces or high or low spots in excess of 1/8 inch in 8 feet when measured with an 8-foot straightedge in any direction. Tile floors pitched to a floor drain shall be measured at any point along an 8-foot radius from the floor drain.

3.4 SCHEDULES

3.4.1 Repairing

Damaged and unacceptable portions of completed work shall be removed and replaced with new work to match adjacent surfaces at no additional cost to the Government.

3.4.2 Cleaning

Upon completion of setting and grouting, tile shall be sponged and washed thoroughly and polished with clean, dry cloths.

Surfaces of the work, and adjacent surfaces soiled as a result of this work, shall be cleaned. Equipment, surplus materials, and rubbish from the work shall be removed from the site.

-- End of Section --

SECTION 09510

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 635	(2000) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C 636	(2003) Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM E 1264	(1998) Acoustical Ceiling Products
ASTM E 84	(2003) Surface Burning Characteristics of Building Materials

1.2 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Installation Drawings shall be submitted for Acoustical Ceilings showing intermediate framing of hanger supports that fall between framing members; fastening of suspension system to top plate of nonbearing partitions; hanger fastenings at roof framing members and at main runners; acoustic unit support at ceiling fixtures; the splicing method for main and cross runners; positioning of splines; and the suspension system structural classification in accordance with ASTM C 635.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items showing UL classification of fire-rated ceilings giving materials, construction details, and UL design number and fire protection time rating for each acoustic ceiling assembly, and showing conformance to the referenced standards contained in this section.

Acoustic Materials
Suspension System Materials

SD-04 Samples

Samples of the following shall be submitted in accordance with paragraph entitled, "Acoustical Ceiling Information," of this section.

Acoustic Units
Suspension System Members
Anchorage Devices
Fasteners

After approval, samples may be used in the construction provided each sample is clearly identified and its location recorded.

SD-08 Manufacturer's Instructions

Manufacturer's instructions shall be submitted showing printed instructions covering installation of Acoustic Materials and Suspension Systems.

SD-12 LEED Submittals per Section 01352

1. Credit MR 4.1 and 4.2: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products containing recycled content.
 - a. Include statements indicating costs for products having recycled content.
2. Credit EQ 4.1: Manufacturer's product data for adhesives and sealants, including a printed statement of VOC content.

1.4 ACOUSTICAL CEILING INFORMATION

Installation Drawings shall be submitted for acoustical ceilings showing intermediate framing of hanger supports that fall between framing members; fastening of suspension system to top plate of nonbearing partitions; hanger fastenings at roof framing members and at main runners; acoustic unit support at ceiling fixtures; the splicing method for main and cross runners; positioning of splines; and the suspension system structural classification in accordance with ASTM C 635.

Samples of the following shall be submitted accordingly:

Acoustic Units: Three 6 by 6 inch samples of each type and pattern to

illustrate the manufacturer's standard color chart and appearance range.

Suspension System Members: Three 1-foot samples of each type.

Anchorage Devices: Three full-size samples of each type.

Fasteners: Three full-size samples of each type.

PART 2 PRODUCTS

2.1 ACOUSTIC MATERIALS

Units shall be prefabricated, mineral base conforming to ASTM E 1264, Type III. Exposed to view surfaces of the units shall be a factory-applied, white finish.

Flame spread index shall not be more than 25, and shall conform to ASTM E 84, Class A.

Light reflectance coefficient Grade (LR), shall conform to ASTM E 1264, and be 0.75 or more.

Panels shall be nominal 24 by 24 inches by not less than 3/4 inch thick, with bevel, rabbeted edges.

Pattern shall be fissured.

Panels to contain a minimum of 30 percent recycled content.

2.2 SUSPENSION SYSTEM MATERIALS

Suspension system materials shall conform to ASTM C 635.

2.2.1 Exposed, Direct-Hung Main Runners

Main runners shall be cold-formed bulb-tee sections, double-web type, fabricated from steel sheets. Web height shall be not less than 1-1/2 inches with the bottom flange width not less than 15/16 inch. Webs shall be drilled or grooved to receive cross runner end tabs and main runner splices. Structural classification shall be heavy duty in accordance with ASTM C 635.

Finish of the exposed-to-view surface of main runners shall be baked-on white enamel. Finish shall pass the high-humidity test specified in ASTM C 635.

2.2.2 Cross Runners and Accessories

Cross runners shall be designed for use with the type and structural classification of the main runners used. Bottom flange shall be the same width as the main runner listed.

Finish of the exposed-to-view surface of the cross runners shall be the same as main runners.

Antibreather splines, hold-down clips, main runner connectors and other accessories required to complete the ceiling installation shall be provided. Such accessories shall be designed for use with the type of main runner used.

2.2.3 Wall Moldings

Moldings shall be cold-formed angle sections fabricated from steel sheets.

Finish of exposed-to-view surfaces of moldings and corner caps shall be the same as the runners.

2.2.4 Hanger Wire

Hanger wire shall be 12-gage galvanized, soft annealed, mild steel wire in accordance with ASTM C 636.

PART 3 EXECUTION

3.1 GENERAL

Metal ceiling suspension systems and acoustic material shall be installed in accordance with the manufacturer's recommendations and ASTM C 636.

3.2 ARRANGEMENT OF ACOUSTIC CEILINGS

Suspension system shall be so arranged that acoustic units less than one-half width do not occur. Tile joint or centerline shall not center on ceiling fixtures.

Runners and acoustic units shall be so arranged that joints are parallel with room axes in both directions.

3.3 PLACING SUSPENSION SYSTEM MEMBERS

Hanger wires shall be vertical and suspended from structural supporting members as follows:

Wires shall be secured to the bottom chord of joists or structural members by wire-tying or by metal clips designed for the purpose.

Moldings shall be installed at walls and other vertical surfaces, except for demountable metal partitions having caps designed to receive suspension system members.

3.4 SETTING ANCHORAGE DEVICES

Anchorage devices shall be set in masonry, concrete or other material in accordance with the anchorage device manufacturer's printed instructions. Drilled holes shall be left rough, not reamed, and free from drill dust.

-- End of Section --

SECTION 09650

RESILIENT FLOORING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM F 1066 (1999) Vinyl Composition Floor Tile

1.2 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Vinyl Composition Tile
Base
Vinyl Reducer Strips
Vinyl Feature Strips
Substrate Primer/Sealer
Adhesive
Edge Strips

SD-04 Samples

Samples of Manufacturer's Standard Color Charts shall be submitted in accordance with paragraph entitled, "Manufacturer's Information," of this section.

SD-08 Manufacturer's Instructions

The following items shall be submitted in accordance with paragraph entitled, "Manufacturer's Information," of this section.

Manufacturer's Instructions
Preventive Maintenance and Inspection

SD-12 LEED Submittals per Section 01352

1. Credit EQ 4.1: Manufacturer's product data for adhesives, including printed statement of VOC content.
2. Credit MR 4.1 and 4.2: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products containing recycled content.
 - a. Include statements indicating costs for products having recycled content.

1.4 DELIVERY, HANDLING, AND STORAGE

Materials shall be delivered to the project site in their original packages or containers bearing labels clearly identifying the manufacturer, brand name, and quality or grade.

Materials shall be stored in their original unbroken packages or containers in the area in which they will be installed.

1.5 MANUFACTURER'S INFORMATION

Manufacturer's Standard Color Charts shall be submitted for resilient flooring showing the manufacturer's recommended color and finish selections.

Manufacturer's Instructions shall be submitted showing printed instructions covering installation of resilient flooring systems.

Preventive Maintenance and Inspection shall be submitted showing the resilient flooring material manufacturer's recommended cleaning and application methods.

PART 2 PRODUCTS

For design purposes, vinyl composition and vinyl base have been chosen and are located on Sheet A5.1.

2.1 MATERIALS

2.1.1 General Requirements

Resilient flooring, base, and edging strips shall be the manufacturer's standard color range.

2.1.2 Vinyl Composition Tile

Tile shall conform to ASTM F 1066, Composition I, 12 by 12 inches square, Class 2. Thickness shall be 1/8 inch.

Shall be composed of 85% natural limestone and contain post-industrial recycled vinyl content.

2.1.3 Base

Base shall be 100 percent reprocessed vinyl composition and the selected style conforming to FS SS-W-40.

Base, exclusive of corners, shall be furnished in rolls not less than 96 feet long. Each wing of corners shall be not less than 2 inches long. Minimum overall thickness shall not be less than 0.125 inch and 4 inches high.

2.1.4 Vinyl Reducer Strips

Vinyl reducer strips shall conform to FS SS-T-312.

Strips shall be 1-inch wide, in the lengths required to minimize joints, and 1/8-inch thick.

2.1.5 Vinyl Feature Strips

Vinyl feature strips shall conform to FS SS-T-312 and shall be 1/8-inch thick.

2.1.6 Substrate Primer/Sealer

Substrate primer sealer shall comply with the resilient flooring manufacturer's recommendations for the type and location of substrate and the end use of the area to be covered. Primer/sealer shall be nonstaining to the resilient flooring.

Primer/sealer shall comply with VOC limits set forth in Section 01352 "LEED Requirements."

2.1.7 Adhesive

Emulsion adhesive shall be used with emulsion primer. Cutback adhesive shall be used with cutback primer. Adhesive shall be nonstaining to the resilient flooring. Adhesive for stair treads shall be the type recommended by the manufacturer.

Adhesives shall comply with VOC limits set forth in Section 01352 "LEED Requirements."

2.1.8 Edge Strips

Edge strips shall be extruded-aluminum alloy conforming to ASTM B 221/B 221M, Temper F, 1/8-inch thick and 3/4-inch wide, butt type, and rounded on the exposed edge. Strips shall be installed in accordance with the manufacturer's recommendation.

PART 3 EXECUTION

3.1 CONDITIONS AT BUILDING

Specified materials shall be installed only when normal temperature and

humidity conditions approximate the interior conditions of the building that will exist when occupied.

Installation of the resilient flooring shall be deferred until other work that might cause damage to flooring has been completed.

3.2 PREPARATION OF SUBSTRATE SURFACES

Surfaces to receive specified materials shall be clean, smooth, cured, and free from materials detrimental to achieving the required bond.

Concrete substrate surfaces shall be coated completely with a primer/sealer in accordance with the resilient-material manufacturer's recommendations.

Cracks, rough areas, joints, and other surface defects in the concrete shall be filled with a material recommended by the stair-tread manufacturer. Ridges, trowel marks, and other surface projections shall be ground smooth.

3.3 APPLICATION OF FLOORING AND BASE

Application of flooring shall be in accordance with the flooring manufacturer's recommendations.

3.4 APPLICATION OF VINYL STRIPS

Vinyl reducer strips shall be applied in conjunction with the specified flooring materials where required. Reducer strips shall be tightly butted to the resilient flooring with the fewest possible seams, in accordance with the manufacturer's instructions.

Vinyl feature strips shall be applied in conjunction with the flooring materials and patterns. Feature strips shall be tightly butted to the resilient flooring with the fewest possible seams, as approved by the manufacturer.

3.5 APPLICATION OF EDGE STRIPS

Edge strips shall be installed at exposed edges of resilient flooring and where thresholds are not required. Top surface shall be flush with resilient flooring. Strips shall be secured to the subfloor as recommended by the manufacturer.

3.6 CLEANING AND PREPARATION

Following application of flooring, the Contractor shall thoroughly clean and prepare the floor.

Stair-tread surfaces shall be cleaned of foreign substances in accordance with the stair tread manufacturer's cleaning instructions.

3.7 APPLICATION OF STAIR TREADS

Application of the adhesive and stair treads shall be in accordance with

the manufacturer's recommendations.

3.8 ACCEPTANCE PROVISIONS

3.8.1 Rejection

Floor surfaces will be rejected when colors or patterns do not match the color or pattern of approved samples, and when chipped, cracked, stained, or mismatched stair treads occur.

3.8.2 Repairing

Damaged and unacceptable portions of the completed work shall be removed and replaced with new work to match adjacent surfaces at no additional cost to the Government.

3.8.3 Cleaning

Surfaces of the work, and adjacent surfaces soiled as a result of the work, shall be cleaned. Equipment, surplus materials, and rubbish from the work shall be removed from the site.

3.9 EXTRA MATERIAL

Upon completion of the vinyl composition tile flooring installation, spare tiles of each type, color, and pattern from the same lot as those installed shall be furnished at the rate of five tiles for each 1,000 tiles or fraction thereof installed.

Upon completion of the sheet vinyl flooring installation, extra material of each type, color, and pattern from the same lot as installed shall be furnished at the rate of 1.0 percent of the area installed.

Upon completion of the stair-tread installation, spare treads of each type, color, and pattern from the same lot as those installed shall be furnished at the rate of 1 tread for each 50 treads installed.

-- End of Section --

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SECTION 09680

CARPET

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 648	(2003) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
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CARPET AND RUG INSTITUTE (CRI)

CRI 104	(2002) Standard for Installation Specification of Commercial Carpet
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1.2 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Installation drawings shall be submitted for the following items diagramming the location of seams, edge moldings, and carpet direction for approval prior to installation.

Carpet
Carpet Moldings

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Carpet
Carpet Moldings

SD-04 Samples

The following samples shall be submitted:

Two samples, each 8 inches square, of each type of Carpet to be used.

The following samples shall be submitted in accordance with the paragraph entitled, "Installation," of this section.

Seam Tape
Edge Molding
Accessories

SD-07 Certificates

Certificates shall be submitted for following showing conformance with the referenced standards contained in this section.

Carpet
Carpet Moldings

SD-08 Manufacturer's Instructions

Manufacturer's instructions shall be submitted showing printed instructions covering Installation of carpet.

SD-12 LEED Requirements per Section 01352

1. Credit MR 4.1 and 4.2: List of proposed materials with recycled content.
 - a. Indicate cost, post-consumer recycled content, and post-industrial recycled content for each product having recycled content.
2. Credit EQ 4.1: Manufacturer's product data for adhesives and sealants, including printed statement of VOC content.
3. Credit EQ 4.3: Manufacturer's product data for carpet including printed statement of VOC content.

PART 2 PRODUCTS

2.1 FACE CARPET MATERIALS

The Carpet Manufacturer shall provide a statement from the U.S. EPA that product meets the guidelines of Presidential Executive Order 13101 for recycled content.

The carpet manufacturer shall provide a statement indicating the carpet system meets or exceeds the Carpet and Rug Institute Green Label Indoor Air Quality Test Program.

Refer to Section 02220, Demolition for additional requirements.

Existing carpet materials scheduled for removal and demolition shall be

collected and returned to one of the sources specified herein for recycling.

The carpet manufacturer for work of this Section shall submit a statement and certify that 100 percent of the existing carpet materials scheduled for removal and demolition will be recycled and that no portion of the existing carpet materials will be land filled or incinerated.

Submit delivery tickets with signed receipt signatures of one of the sources as specified herein as evidence that 100 percent of the existing carpet materials scheduled for demolition and removal were in fact collected and returned for recycling.

2.1.1 Polyester Carpet Face Fibers

For informational purposes, a list of sources known to recycle polyester carpet face fibers is provided below. Note that the Contractor is not limited to these sources. An approved product from other sources may be submitted for the Government's approval during construction.

Acceptable manufacturer's include, but are not limited to:

Bretlin, Inc.
LaFayette, Georgia

Central Vermont Carpet
Barre, Vermont

Environmental Building Supplies
Portland, Oregon

Image Industries
Amuchee, Georgia

Martin Color-FI
Edgefield, South Carolina

Talisman Mills, Inc.
Mequon, Wisconsin

2.1.2 Adhesives

Water resistant, mildew resistant, non-staining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.

1. Adhesives and sealants shall comply with VOC limits set forth in Section 01352 "LEED Requirements."

2.2 CARPET TYPE AND CONSTRUCTION

For design purposes carpet was specified and is located on Sheet A5.1.

The following specifies the construction for broadloom carpet.

Type shall be tufted textured patterned loop.

Finished pile height shall be 5/64 inch.

Face weight shall be 22 oz./yd².

Backing: Primary shall be unibond.

Yarn Type: Antron Legacy nylon by Invista.

2.2.1 Flammability

Radiant panel test shall be Class I, 0.45 watt/cm² or greater in accordance with ASTM E 648.

Smoke density shall be 450 or less in accordance with NFPA 258.

2.3 CARPET MOLDINGS

Carpet moldings, vinyl, shall be installed where floor covering material changes or carpet edge does not abut a vertical surface.

PART 3 EXECUTION

3.1 INSTALLATION

Samples of each type of Seam Tape, Edge Molding, and any other Accessories to be used shall be submitted.

Carpeting shall be installed in accordance with CRI 104 and the carpet manufacturer's instructions.

Type of installation required for this project is as follows:

Direct Glue Down

Contiguous carpeting shall be a product of the same dye lot.

Corrections in measurements made by the Contractor shall be at no additional cost to the Government.

Transportation of carpet within the jobsite shall be the responsibility of the Contractor.

Removal and replacement of furniture shall be the responsibility of the Contractor.

3.2 PREPARATORY WORK

Contractor shall verify that surfaces to receive carpet are thoroughly clean, dry, dust-free, and in a satisfactory condition to be carpeted. Contractor shall notify the Government in writing of any conditions that will prevent the production of unsatisfactory work. Start of carpet installation shall be an indication of acceptance of the surfaces as being

satisfactory for installing carpeting and he shall automatically assume the responsibility for any unacceptable finish work caused by floor conditions.

3.3 ACCEPTANCE PROVISIONS

Contractor shall be fully responsible for the installation upon completing of each area. Installation will be inspected and approved by the Contracting Officer prior to acceptance.

Damaged and unacceptable portions of completed work shall be removed and replaced with new carpeting.

3.4 CLEANING

Surfaces of new carpeting and adjacent surfaces soiled as a result of this work shall be cleaned thoroughly. Equipment, surplus materials, and rubbish from work shall be removed from the site.

-- End of Section --

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SECTION 09725

VINYL WALL COVERING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ASTM INTERNATIONAL (ASTM)

ASTM D 751 (2000) Coated Fabrics

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD 191 (Rev C) Textile Test Methods

FS CCC-W-408 (2003d) Wallcovering, Vinyl Coated

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir (2003) Building Materials Directory

1.2 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Fabrication Drawings shall be submitted for in accordance with paragraph entitled, "General Information," of this section.

Vinyl Wall Covering consisting of fabrication and assembly details to be performed in the factory.

Installation drawings shall be submitted for vinyl wall covering in accordance with the paragraph entitled, "Installation," of this section.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items.

Vinyl Wall Covering
Adhesive, Primer, and Sealer

SD-04 Samples

Wall Covering: Two samples, 3 yards long by the width specified, of each color and grain to be installed in the work, as required to illustrate material weight, color, shade, decorative design, and embossing when required.

SD-07 Certificates

Certificates shall be submitted for Vinyl Wall Covering including the following.

Certified laboratory test reports of the physical properties for vinyl wall covering, as specified

Certificates of Compliance for UL fire hazard classification listing, as specified

Certificates of Compliance for contact adhesive

SD-08 Manufacturer's Instructions

Manufacturer's instructions shall be submitted for the following items showing printed instructions covering installation.

Wall Covering

Preventative maintenance and inspection shall be submitted for Vinyl Wall Covering showing the manufacturers recommended cleaning materials and application methods, including precautions in the use of cleaning materials that may be detrimental to the wall covering surface when improperly applied.

SD-09 Manufacturer's Field Reports

Records of vinyl wall covering system's shall be submitted in accordance with paragraph entitled, "General Information," of this section.

SD-12 LEED Submittals per Section 01352

1. Credit MR 4.1 and 4.2: List of proposed materials with recycled content.
 - a. Indicate cost, post-consumer recycled content, and post-industrial recycled content for each product having recycled content.
2. Credit EQ 4.3: Manufacturer's product data for adhesives and sealants including printed statement of VOC content.

1.4 DELIVERY, HANDLING, AND STORAGE

Materials shall be delivered to the project site in their original packages or containers bearing labels clearly identifying the manufacturer, brand name, quality or grade, and UL fire-hazard classification when applicable.

Materials shall be stored in their original, unbroken packages or containers, in a weathertight and dry place having a temperature not less than 65 degrees F, for at least 24 hours before the start of wall covering installation.

1.5 GENERAL INFORMATION

Fabrication Drawings shall be submitted for vinyl wall covering systems consisting of fabrication and assembly details to be performed in the factory.

Records of vinyl wall covering manufacturer's name or trademark, wall covering brand name, color, and grain designation shall be submitted.

PART 2 PRODUCTS

2.1 VINYL WALL COVERING

For design purposes, a wall covering was picked and is located on Sheet A5.1. Wall covering shall be made of wood pulp and recycled ply fibers, inks are to be water-based and contain no heavy metals.

Vinyl wall covering shall be an integrally pigmented, laminated to, or combined with, a fabric backing.

Wall covering shall be medium-duty type, finish as specified, conforming to FS CCC-W-408, Type II, and the following modifications:

Wall covering to be breathable to reduce mold and mildew.

Wall covering substrate to be created in a manufacturing facility rated ISO 14001.

Physical properties shall be as follows:

<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>VALUE</u>
Total weight,	FED-STD 191, Test 5041	Not less than 9 ounces per lineal yard
Adhesion of coating to fabric backing	ASTM D 751	Not less than 3 pounds pull per inch of width

2.2 WALL COVERING ADHESIVE, PRIMER, AND SEALER

Wall covering adhesive, primer, and sealer shall comply with the vinyl wall covering manufacturer's recommendations. These materials shall be mildew-resistant and nonstaining to the wall covering coating.

Wall covering adhesive, primer and sealer shall comply with VOC limits set forth in Section 01352 "LEED Requirements."

2.3 UL FIRE HAZARD CLASSIFICATION LISTING AND LABEL

Vinyl wall covering and adhesive shall be listed in UL Bld Mat Dir and shall bear UL label and marking indicating the fire-hazard classification of the wall covering as applied to non-asbestos-cement board and using the adhesive recommended by the wall covering manufacturer, as follows:

Flame spread shall be not more than 25.

Fuel contributed shall be not more than 15.

Smoke developed shall be not more than 50.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Conditions at Building

Spaces to receive vinyl wall covering shall be maintained at a temperature of at least 70 degrees F at wall base level for at least 48 hours prior to, during, and for 48 hours after the completion of the wall covering installation.

Specified materials shall be installed only when ambient temperature and humidity conditions approximate the interior conditions that will exist when the building is occupied.

3.1.2 Preparation of Substrate Surfaces

Surfaces to receive specified materials shall be clean, smooth, thoroughly cured, and free from materials detrimental to achieving the required bond.

Before start of wall covering application, plaster surfaces shall be tested for moisture content with a moisture detector. Moisture content shall not exceed the percentage recommended by the wall covering manufacturer.

Substrates surfaces shall be primed or sealed in accordance with the wall covering manufacturer's recommendations for the type of substrate material.

3.1.3 Wall Covering Application

Application of adhesive and wall covering shall be in accordance with the wall covering manufacturer's approved descriptive data, and as specified. Wall covering seams shall be vertical and plumb, and at least 6 inches away from any corner; horizontal seams will not be permitted. Wall covering shall be continuous over internal and external corners. Switchplates,

wallplates, and surface-mounted fixtures shall be removed and the wall covering shall be cut evenly to the edges of the outlet box or support. Selvages shall be trimmed in the field; trimming shall be sufficient to ensure color uniformity and matching of grain from one wall covering panel to the panel butted against it. Edges shall extend not less than 1/2 inch behind the applied base.

3.1.4 Cleaning

Wall covering surface shall be cleaned of excess adhesive and soil in accordance with the wall covering manufacturer's cleaning instructions.

3.1.5 Excess Materials

After completion of wall covering installation, usable Remnants, as determined by the Contracting Officer, shall be separated by type, color, and pattern, and rolled and wrapped for protection from dirt, moisture, and infestation.

3.2 ACCEPTANCE PROVISIONS

3.2.1 Rejection

Vinyl wall covering work will be rejected for any of the following deficiencies:

Wall covering having colors and grains that do not match the color or grain of the approved sample

Finished wall covering having horizontal seams, out-of-plumb vertical seams, open seams, air pockets, buckles, wrinkles, loose edges, mismatched panels, or stains that cannot be removed by cleaning

3.2.2 Repairing

Damaged and unacceptable portions of completed work shall be removed and replaced with new work to match adjacent surfaces at no additional cost to the Government.

3.2.3 Cleaning

Surfaces of the new work, and adjacent surfaces soiled as a result of the work, shall be cleaned. Equipment, surplus materials, and rubbish from the work shall be removed from the site.

-- End of Section --

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SECTION 09801

POWDER COATINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.2 SCOPE

This specification covers powder coatings for interior steel, aluminum, copper-nickel and bronze equipment, furniture, and electrical box surfaces and on exterior steel, aluminum, copper-nickel, and bronze surfaces exposed to marine atmosphere, high humidity, seawater, and weathering.

1.3 CLASSIFICATION

Powder coatings covered by this specification are of the following types and classes as specified herein.

Type I:	Epoxy.
Type II:	Epoxy polyester hybrid.
Type III:	Polyester.
Type IV:	Polyester triglycedial isocyanurate (TGIC).
Type V:	Polyester urethane hybrid.
Type VI:	Acrylic.
Type VII:	Acrylic polyester hybrid.
Type VIII:	Acrylic urethane hybrid.
Type IX:	Urethane.
Type X:	Polyurethane.
Type XI:	Vinyl.
Type XII:	Nylon.

Classes: The classes of powder coatings are as follows:

Class 1:	Interior, dry service.
Class 2:	Interior, wet spaces, immersion service.
Class 3:	Exterior.

1.4 SUBMITTALS

SD-12 LEED Submittals per Section 01352

1. Credit EQ 4.2: Manufacturer's product data for paint and coatings including printed statement of VOC content and chemical components.

PART 2 APPLICABLE DOCUMENTS

2.1 GOVERNMENT DOCUMENTS

Specifications, Standards, and Handbooks: The Specifications, standards, and handbooks listed herein form a part of this document. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS).

Other Government Documents, Drawings, and Publications: The following other Government documents, Drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

Department of Labor (DOL): Code of Federal Regulations, Title 29, Part 1910, 1915, 1917, 1918, 1926, and 1928 - Hazard Communications Act, Final Rule. (Application for copies should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

Environmental Protection Agency (EPA): SW 846, Chapter 3.3, method 7471 - Test Methods for Evaluating Solid Waste; Physical/Chemical Methods. (Application for copies should be addressed to National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.)

2.2 ORDER OF PRECEDENCE

In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

PART 3 REQUIREMENTS

3.1 QUALIFICATIONS

The powder coatings furnished under this specification shall be products with are authorized by the qualifying activity for listing on the applicable qualified products list at the time of award of Contract.

3.2 MATERIALS

The material shall be a finely ground, free-flowing powder of a one-component material consisting of a resin and curing agent system, as specified catalysts, fillers, colorants, and flow control agents in order to form a powder formulation capable of being electrostatically applied and conforming to the requirements of this specification. Powder coat materials shall be similar to Sherwin Williams, Pondura Polyurethane Powder coating, 1.0 - 3.0 mils dft, or approved equal by the Contracting Officer's Representative.

Workmanship: The powder shall be uniform, free from grit, and free of solvent, abrasives, water, chlorides, or other impurities.

Hydrogen Cyanide: When specified, the combustion products of the coating in an as-applied form, shall not contain detectable concentrations of hydrogen cyanide. Monitoring for hydrogen cyanide shall be performed in accordance with the guidance provided in ASTM E 800.

Toxic Products: When evaluated as specified, the materials used in the powder coating shall not contain known or potentially carcinogenic materials, as identified by:

The Occupational Safety and Health Administration (regulated carcinogens).
International Agency for Research on Cancer (IARC) (latest monographs).
National Toxicology Program (latest annual report).

The manufacturer is responsible for maintaining "carcinogen free" materials.

The powder coating, as supplied, shall not contain the following materials in excess of 0.06 percent by weight:

Asbestos or any asbestos-form materials.
Benzene.
Toluene.
Chlorinated solvents.
Hydrolyzable chlorine derivatives.
Lead.
Chromium.
Cadmium.
Mercury.
Nitrosamines.

Toxicity: The powder coating shall have no adverse effect on the health of personnel when used for its intended purpose in accordance with the precautions delineated on the Material Safety Data Sheet and Hazardous Chemical Warning Label.

Material shall comply with VOC limits set forth in Section 01352 "LEED Requirements" for interior paints and coatings.

Material Safety Data Sheet (MSDS): The contracting activity shall be provided by a material safety data sheet at the time of Contract Award. The MSDS shall be provided in accordance with the requirements of FED-STD-313. The MSDS shall be included with each shipment of the material covered by this specification.

Disposal Requirement: Waste powder and removed coating shall be disposed of in an ordinary landfill. To minimize dusting at landfills, the powder coating shall be sintered (solidified) before disposal. All disposal shall be in accordance with both the state and federally imposed Environmental Protection Agency (EPA) regulations.

Metal Content: The content of each soluble metals and total content of each metal of the powder coating shall be not greater than the values listed in Tables I and II when tested as specified.

TABLE I. Soluble Metals Content. 1/

Soluble Metal and/or Its Compound	Maximum, mg/L
Antimony and/or its compounds	15
Arsenic and/or its compounds	5

Barium and/or its compounds (excluding barite)	100
Beryllium and/or its compounds	0.75
Cadmium and/or its compounds	1
Chromium (VI) compounds	5
Chromium and/or chromium (III) compounds	560
Cobalt and/or its compounds	10
Copper and/or its compounds	25
Fluoride salts	180
Lead and/or its compounds	0.5
Mercury and/or its compounds	0.2
Molybdenum and/or its compounds	350
Nickel and/or its compounds	10
Selenium and/or its compounds	1
Silver and/or its compounds	5
Tantalum and/or its compounds	800
Thallium and/or its compounds	7
Tungsten and/or its compounds	800
Vanadium and/or its compounds	24
Zinc and/or its compounds	250

1/ The values in Table I are instantaneous values for toxic materials and are not time weighted averages.

TABLE II. Total Metals Content. 1/

Metal	Maximum, %WT
Antimony and/or its compounds	0.015
Arsenic and/or its compounds	0.001
Barium and/or its compounds (excluding barite)	0.10
Beryllium and/or its compounds	0.0002
Cadmium and/or its compounds	0.0005
Chromium (VI) compounds	0.0005
Chromium and/or chromium (III) compounds	0.56
Cobalt and/or its compounds	0.0005
Copper and/or its compounds	0.01
Fluoride salts	0.18
Lead and/or its compounds	0.005
Mercury and/or its compounds	0.0002
Molybdenum and/or its compounds	0.35
Nickel and/or its compounds	0.02
Selenium and/or its compounds	0.001
Silver and/or its compounds	0.001
Tantalum and/or its compounds	0.8
Thallium and/or its compounds	0.007
Tungsten and/or its compounds	0.8
Vanadium and/or its compounds	0.01
Zinc and/or its compounds	0.25

1/ The values in Table II are instantaneous values for toxic materials and are not time weighted averages.

3.3 COATING CHARACTERISTICS

When applied to a substrate and subjected to a heating cycle, as required by the Contractor, the material shall melt, fuse, and subsequently cure to

form a coating which conforms to all the requirements of this specification. The Contractor shall specify the application procedure and shall provide detailed health and safety information, by means of Material Safety Data Sheets, Product Specification/Data Sheets, and Hazardous Chemical Warning Labels, needed to ensure:

Optimum performance of the powder coating.
All procedures are performed safely.

3.4 FILM PROPERTIES

The powder coating shall be applied by established commercial powder coating methods over abrasive blasted steel, aluminum, copper-nickel, or bronze surfaces, as applicable. Coatings shall have a total dry film thickness for interior, dry service surfaces, and exterior and interior wet spaces immersion service surfaces, aluminum, copper-nickel, or bronze surfaces of 51 to 102 micrometers (um) (2 to 4 mils) and 102 to 152 um (4 to 6 mils), respectively. The cured coating shall be uniform, smooth, even, and free of runs, sags, and streaks. The coating shall be not less than 0.5 mm (2.0 mils) above the blasted profile.

3.5 CURE TIME

The powder shall have a cure cycle (time and temperature) of less than 30 minutes at a temperature of less than 400 +/- 10 deg F and meet the cure test specified. At 350 +/- 10 deg F, the powder shall have an overbake stability of at least 100 percent of the recommended cure time. The temperature and time duration of the powder coating cure cycle shall not effect the material properties of the coated substrate.

3.6 GEL TIME

Epoxy gel time of a film of applied powdered materials shall be not less than 20 seconds or greater than 60 seconds when tested as specified. Other powders gel time of the film of the applied powdered materials shall be not greater than 125 seconds when tested as specified. The gel time for Class 2 powdered materials shall not be less than 4 seconds nor greater than 60 seconds when tested as specified. Types XI and XII are not required to meet this requirement.

3.7 WEATHERING PROPERTIES (FOR CLASS 3 ONLY)

The weathering properties for Class 3 only shall be as follows:

Accelerated Weathering: The cured film of applied powder coating shall show no cracking, a loss of not greater than 30 percent of the gloss measured before exposure, no color change, blistering, wrinkling, or loss of adhesion of the coating nor evidence of substrate corrosion after 1,000 hours exposure to accelerated weathering.

Humidity Resistance: The cured film of applied powder coating shall show no corrosion, blistering, wrinkling, or loss of adhesion.

3.8 COLOR

Color of the cured film of applied powder coatings shall be as specified and in accordance with FED-STD-595 color chip.

3.9 FLEXIBILITY (FOR CLASSES 1 AND 3 ONLY)

When specified, the cured film of applied powder coating shall show no cracking or loss of adhesion in the bend area.

3.10 ADHESION

The cured film of applied powder coating shall have a minimum classification of 5B.

3.11 SPECULAR GLOSS

Initially, the 60 degree specular gloss of the cured film of applied powder coating (for all colors except Navy haze-gray) shall have a minimum requirement of 45 and a maximum requirement of 85. The 60 degree specular gloss requirement for Navy haze-gray shall have a minimum requirement of 45 and a maximum requirement of 60.

3.12 DIELECTRIC STRENGTH

When specified, the cured film of applied powder coating shall have an average dielectric strength greater than 30 volts per micrometer (762 volts per mil).

3.13 THERMAL SHOCK RESISTANCE (FOR CLASS 3 ONLY)

The cured film of applied powder coating shall withstand 10 cycles between 165 +/- 4 deg F) and minus 65 +/- 4 deg F without cracking, checking, or disbonding.

3.14 IMPACT RESISTANCE

The cured film of applied powder coating shall provide a coating that will have a direct and reverse impact resistance of not less than 160 inch pounds and 25 inch pounds respectively, without forming a holiday when inspected with a 67.5 volt detector. Except Type XII shall have a direct and reverse impact resistance of not less than 125 inch pounds without forming a holiday when inspected with a 67.5 volt detector.

3.15 ABRASION RESISTANCE

Weight loss from the cured film of applied epoxy powder coating shall be not greater than 0.0001 pound and all other powder coatings not greater than 0.0002 pound.

3.16 SALT SPRAY RESISTANCE (FOR CLASSES 2 AND 3)

A cured film of applied powder coating shall show undercutting of not greater than 1/4 inch from the score lines. There shall also be no blistering, wrinkling, or loss of adhesion of the coating or any general

surface corrosion or pitting.

3.17 FLUID RESISTANCE PROPERTIES (FOR CLASS 2 ONLY)

The fluid resistance properties for Class 2 shall be as follows:

Boiling Water Immersion: The cured film of applied powder coating shall show no wrinkling, blistering, or loss of adhesion.

Hydrocarbon Immersion: A cured film of applied powder coating shall show no softening, blistering, rusting, or other visible defects.

Hydraulic Fluid Immersion: A cured film of applied powder coating shall show no softening, blistering, rusting, or other visible defects.

3.18 CHEMICAL RESISTANCE

The cured film of applied powder coating shall not blister, soften, lose bond, discolor, change greater than 50 percent in gloss, nor develop holidays and intentionally made holes shall exhibit no undercutting during the 45-day test period.

3.19 WEATHERING PROPERTIES (FOR CLASS 2 ONLY)

The weathering properties for Class 2 only shall be as follows:

Humidity Resistance: The cured film of applied powder coating shall show no corrosion, blistering, wrinkling, or loss of adhesion.

3.20 HARDNESS

The cured film of applied powder coating shall have a pencil hardness of not less than 2H.

3.21 HOLIDAY

The cured film of applied powder coating shall be free of holidays.

3.22 SHELF LIFE

Powder coating materials shall meet the requirements of this specification for 1 year from the date of manufacture when stored unopened in the original container at or below 72 deg F and at a relative humidity less than 50 percent.

3.23 OUTGASSING (FOR CLASSES 1 AND 2)

Outgassing, when conducted as specified, shall not contaminate a ship or submarine atmosphere.

3.24 TOUCHUP

The cured powder coating, when touched up with silicone alkyd copolymer enamel conforming to MIL-E-24635, Type II, Class 2, shall exhibit good adhesion. For Type I powder coatings, touchup powder coatings with epoxy-polyamide, exterior topcoat conforming to MIL-P-24441 and Formula

151, Type I or MIL-P-24441/2.

3.25 LABEL

Manufacturer's container label instructions for the powder coating shall be in accordance with the requirements of 29 CFR 1910, 1915, 1917, 1918, 1926, and 1928.

3.26 SUBSTITUTION

In lieu of powder coating, Contractor may provide one of the following systems, installed according to manufacturer's requirements. Any substitution must meet VOC limits set forth by Section 01352 "LEED Requirements."

Mild Environment (High-Gloss Finish): One finish coat over an intermediate coat and a primer.

Primer: Acrylic primer applied at spreading rate recommended by manufacturer.

- 1) DuPont: Tufcote 72P Waterborne Acrylic Enamel. Verify VOC content prior to submission.
- 2) ICI: Devflex 4020 DTM Flat Interior/Exterior Waterborne Primer and Finish. Verify VOC content prior to submission.
- 3) International: Intercryl 520 WB Waterborne Acrylic Primer or Finish. Verify VOC content prior to submission.
- 4) Moore: M04 Acrylic Primer. Verify VOC content prior to submission.
- 5) PPG: 90-7XX Series Pitt-Tech One Pack Interior/Exterior Primer Finish DTM Industrial Enamel. Verify VOC content prior to submission.
- 6) R-O: 5269/5281 System Labor Saver Industrial Enamel High Performance Acrylic Primers. Verify VOC content prior to submission.
- 7) S-W: Kem Kromik Universal Metal Primer B50Z Series. Verify VOC content prior to submission.
- 8) Tnemec: Series 18 Enviroprime. Verify VOC content prior to submission.

Intermediate Coat: Acrylic enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils.

- 1) DuPont: Tufcote 72P Waterborne Acrylic Enamel. Verify VOC content prior to submission.
- 2) ICI: Devflex 4208 Interior/Exterior Waterborne Acrylic Gloss Enamel. Verify VOC content prior to submission.
- 3) International: Intercryl 530 WB Waterborne Acrylic Gloss Finish. Verify VOC content prior to submission.
- 4) Moore: M28 Acrylic Gloss Enamel. Verify VOC content prior to submission.
- 5) PPG: 90-3XX Series Pitt-Tech One Pack Interior/Exterior High Performance Waterborne High Gloss DTM Industrial Enamels. Verify VOC content prior to submission.

- 6) R-O: 5200 System Labor Saver Industrial Enamel High Performance Acrylic Semi-Gloss Finishes. Verify VOC content prior to submission.
- 7) S-W: DTM Acrylic Gloss Coating B66W100 Series. Verify VOC content prior to submission.
- 8) Tnemec: Series 28 Tufcryl Acrylic Emulsion. Verify VOC content prior to submission.

Topcoat: High-gloss acrylic enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils.

- 1) DuPont: Tufcote 72P Waterborne Acrylic Enamel. Verify VOC content prior to submission.
- 2) ICI: Devflex 4208 Interior/Exterior Waterborne Acrylic Gloss Enamel. Verify VOC content prior to submission.
- 3) International: Intercryl 530 WB Waterborne Acrylic Gloss Finish. Verify VOC content prior to submission.
- 4) Moore: M28 Acrylic Gloss Enamel. Verify VOC content prior to submission.
- 5) PPG: 90-3XX Series Pitt-Tech One Pack Interior/Exterior High Performance Waterborne High Gloss DTM Industrial Enamels. Verify VOC content prior to submission.
- 6) R-O: 5200 System Labor Saver Industrial Enamel High Performance Acrylic Semi-Gloss Finishes. Verify VOC content prior to submission.
- 7) S-W: DTM Acrylic Gloss Coating B66W100 Series. Verify VOC content prior to submission.
- 8) Tnemec: Series 28 Tufcryl Acrylic Emulsion. Verify VOC content prior to submission.

Automotive paint may be substituted at overhead doors. Must meet VOC limits set forth in Section 01352 "LEED Requirements."

3.27 RESPONSIBILITY FOR INSPECTION

Unless otherwise specified in the Contract or purchase order, the Contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the Contract or purchase order, the Contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

-- End of Section --

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SECTION 09920

ARCHITECTURAL PAINTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items. Data shall include detailed analysis of each coating material required, with constituents measured as percentages of the total weight of coating.

Inhibitive Metal Primer
Pigmented Sealer
Latex Block Filler
Alkali Resistant Primer
Enamel Undercoat
Exterior Wood Primer
Acrylic Latex
Acrylic Epoxy

SD-04 Samples

Manufacturer's Standard Color Charts shall be submitted in accordance with paragraph entitled, "Manufacturer's and Materials," of this section.

SD-07 Certificates

A Safety Plan shall be submitted in accordance with paragraph entitled, "General," of this section.

SD-08 Manufacturer's Instructions

Manufacturer's instructions shall be submitted for architectural coatings including details of thinning, mixing, handling, and application, in accordance with paragraph entitled, "General," of this section.

SD-12 LEED Submittals per Section 01352

1. Credit EQ 4.2: Manufacturer's product data for paint, including printed statement of VOC content and chemical components.

1.3 CONTRACTOR PERSONNEL QUALIFICATION

Personnel assigned to the work shall be certified by the Contractor to have had adequate previous experience in the successful application of paints and coatings similar to those specified.

1.4 DELIVERY, HANDLING, AND STORAGE

Materials shall be delivered in their original, unbroken containers bearing the manufacturer's name and product identification. Containers breached by rough handling shall be removed from the site, together with their contents.

Paint materials, thinners, and cleaners shall be stored in tightly closed containers in a covered, well-ventilated area where they will not be exposed to excessive heat, sparks, flame, or direct sunlight. Water-based materials shall be protected against freezing.

PART 2 PRODUCTS

For design purposes, a paint manufacturer and colors have been selected and are located on Sheet A5.1.

2.1 MANUFACTURER'S AND MATERIALS

Manufacturer's Standard Color Charts shall be submitted showing manufacturer's recommended finish colors. Three color chips of each color and gloss scheduled shall also be submitted.

Product shall comply with VOC limits set forth in Section 01352 "LEED Requirements."

The following are suggested paint manufacturers and their products. Other paint manufacturers' products of equal quality will be considered when submitted and approved by the Contracting Officer.

<u>COATING</u>	<u>WILLIAMS</u>
Acrylic Latex, Egg Shell	Harmony B9 Series
Acrylic Latex, Semi-gloss	Harmony B10 Series

PART 3 EXECUTION

3.1 GENERAL

A Safety Plan shall be submitted for architectural coating systems in

accordance with OSHA regulations.

Manufacturer's recommendations for surface preparation, thinning, mixing, handling, and application shall be considered a part of this specification.

3.2 PROTECTION OF FACILITIES

Contractor shall remove and reinstall or provide acceptable protection for hardware, accessories, lighting and electrical components, factory-finished materials, plumbing fixtures and fittings, and any other materials that may become splattered or damaged by the painting work.

3.3 SURFACE PREPARATION

3.3.1 General Requirements

Surfaces shall be clean, dry, and free from contaminants and foreign matter. Mildew and chalking shall be removed and the surface thoroughly sterilized. Chipped, peeling, or blistered paint shall be removed and the surface spot primed. Hard glossy surfaces shall be dulled and roughened to ensure proper adhesion.

3.3.2 Ferrous Metal

Surfaces shall be free from dirt, oil, grease, wax, and other contaminants. Heavy rust and loose mill scale shall be removed by hand, power tool, or blast cleaning.

3.3.3 Galvanized Steel

Surfaces shall be cleaned of all contaminants using a solvent such as lacquer thinner or xylol.

After cleaning, the surface shall be etched with a phosphoric acid pre-treatment solution.

3.3.4 Aluminum

Surfaces shall be clean, dry, and free from oil and grease. Oxide film and corrosion shall be removed by hand or power tool cleaning.

3.3.5 Wood

Surfaces shall be clean, dry, smooth, and free from oil, grease, and dirt. Knots shall be sealed with a mixture of equal parts of shellac and alcohol. Nail holes, cracks, and other defects shall be filled with plastic wood or putty. Concealed surfaces shall be back-primed before installation.

3.3.6 Masonry

Surfaces shall be free from dirt, oil, grease, wax, form-release compounds, laitance, and other contaminants. Cracks, voids, and other major surface imperfections shall be filled with mortar.

3.3.7 Plaster and Drywall

Surfaces shall be clean and dry. Cracks and other surface imperfections shall be filled with spackling compound and sanded smooth.

3.4 MIXING AND APPLICATION

3.4.1 General Procedures

No exterior painting shall be allowed in rainy weather or when rain is imminent. No paints or coatings shall be applied when the temperature or humidity is outside the limits recommended by the manufacturer.

Paints and coatings shall be applied by brush, roller, or airless spray.

Each coat of material applied shall be free from runs, sags, bubbles, foreign contaminants, variations in color, gloss, and texture, dry overspray, brush and roller marks, holidays (missed areas), or other evidence of poor application.

Paints and coatings shall be thoroughly worked into corners and crevices.

Newly painted surfaces shall be adequately protected from damage.

3.4.2 Procedures

There shall be at least 2 coats of paint applied in accordance with the manufacturer's instructions.

Coatings shall be applied as follows:

Material shall be thoroughly stirred to produce a uniform mixture.

Material shall be thinned for workability and improved spray characteristics, but only according to the manufacturer's instructions.

Each coat shall be applied uniformly at the minimum wet-film thickness specified by the manufacturer.

Special attention shall be given when coating sharp edges, corners, and crevices to ensure complete coverage.

Finish coats shall show good hiding characteristics and uniform appearance.

3.5 ACCEPTANCE PROVISIONS

3.5.1 Inspection

Contractor shall provide qualified personnel for inspection of his work to ensure that the requirements of this section have been fulfilled.

3.5.2 Correction

Spot-painting to correct damaged surfaces will be allowed only when touchup area blends into the surrounding finish. Otherwise, the entire area shall be recoated. Touchup shall be accomplished using the same method of application as was used to apply the original material.

3.6 PROTECTION

"WET PAINT" signs shall be posted to indicate newly painted surfaces.

3.7 PAINT SCHEDULE

<u>SURFACE</u>	<u>PRIMER</u>	<u>UNDERCOAT AND FINISH COAT</u>	<u>FINISH COLOR AND SHEEN</u>
Interior drywall	Pigmented sealer	Water-base acrylic enamel	semigloss
Interior metal	Inhibitive metal primer	Water-base acrylic enamel	semi gloss
Exterior masonry (rough/ porous)	Latex block filler	Acrylic latex	flat
Exterior masonry (smooth)	Alkali- resistant primer	Acrylic latex	flat
Interior drywall	Pigmented	Water-base acrylic	Egg shell

-- End of Section --

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SECTION 09960

HIGH PERFORMANCE COATINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 27	(1982) Basic Zinc Chromate - Vinyl Butyral Wash Primer
SSPC SP 1	(1982) Solvent Cleaning
SSPC SP 2	(1982) Hand Tool Cleaning
SSPC SP 3	(1982) Power Tool Cleaning
SSPC SP 5	(2000) White Metal Blast Cleaning NACE No. 1-2000

U.S. DEPARTMENT OF DEFENSE (DOD)

MS MIL-C-83286	(1995b) Coating Urethane, Aliphatic Isocyanate, For Aerospace Applications
MS MIL-P-24441	(Rev B) General Specification for Paint, Epoxy-Polyamide
MS MIL-P-24441/1	(1991c) Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type I

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-E-496	(2002) Enamel; Heat-Resisting (400 Degrees F, Black)
FS TT-P-28	(1992g) Paint, Aluminum, Heat Resisting (1200 Degrees F)

1.2 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL

PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Material, Equipment and Fixture List shall be submitted in accordance with paragraph entitled, "Delivery, Handling and Storage," of this section.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items including manufacturer's name and identification. Data shall include detailed analysis of each special coating material required for the project, with all the coating constituents measured as percentages of the total weight of the coating. Manufacturer's data concerning application, thinning, and average coverage per gallon shall be included.

Heat-Resistant Coatings
Epoxy Coatings
Polyurethane Coatings
Chlorinated-Rubber Coatings

SD-04 Samples

Sample Color Chips shall be submitted in accordance with paragraph entitled, "Delivery, Handling and Storage," of this section.

SD-07 Certificates

Certificates shall be submitted for following items showing conformance with the referenced standards contained in this section.

Heat-Resistant Coatings
Epoxy Coatings
Polyurethane Coatings
Chlorinated-Rubber Coatings

SD-12 LEED Submittals per Section 01352

1. Credit EQ 4.2: Manufacturer's product data for interior paint and coatings, including printed statement of VOC content and chemical components.

1.4 DELIVERY, HANDLING AND STORAGE

Special coating materials shall be delivered to the project in their original containers bearing manufacturer's name, descriptive label, and coating formulations. Containers shall be new and unopened.

Special coating materials shall be stored in tightly closed containers in a covered, well-ventilated area where they will not be exposed to excessive

heat, fumes, sparks, flame, or direct sunlight. Water-based coatings shall be protected against freezing.

Solvents, thinners, and equipment cleaners shall be stored with the same care as the coating materials.

Material, Equipment and Fixture List shall be submitted consisting of a list of proposed equipment to be used in performance of construction work.

Three color chips at least 12-inches square of each finish color and gloss as scheduled shall be submitted.

1.5 FIELD TESTS

Government may take dry-film tests from time to time on finished surfaces. Additional coatings shall be applied to surfaces where there is less than the minimum specified dry-film thickness.

1.6 PROTECTIONS AND SAFETY PRECAUTIONS

Adjacent materials and equipment shall be protected against damage from spillage, dripping, and spatter of coating materials. Building materials and equipment shall be left clean and with all damaged surfaces corrected. "WET PAINT" signs to indicate newly painted surfaces shall be provided.

Forced ventilation for interior spaces shall be provided during application and drying of coatings to prevent the buildup of toxic or explosive concentrations of solvent vapors.

Fire extinguishers of the required quantity and correct type shall be provided to combat flammable liquid fires.

Rags used to wipe up coating materials, solvents, and thinners shall be disposed of by drenching them with water and putting them in a covered metal container.

1.7 CLEANUP

Application equipment shall be cleaned promptly and thoroughly with a suitable solvent after each use and stored in a clean, covered, well-ventilated container.

At the end of each working day, discarded paint materials, rubbish, dirty rags, and other similar trash shall be removed from the project.

At the completion of the work, paint spots shall be removed from finish surfaces and the project left in a clean condition.

PART 2 PRODUCTS

2.1 HEAT-RESISTANT COATINGS

2.1.1 General

All interior paints and coatings to comply with VOC limits set forth in Section 01352.

2.1.2 Category 1, 50 to 400 Degrees F

Coatings for surface temperatures not exceeding 400 degrees F shall be alkyd resin-based material conforming to FS TT-E-496, Type II, as modified.

Coatings shall be applied in not less than two coats with a dry-film thickness of not less than 4 mils.

First coat shall be an alkyd resin, zinc-pigmented material with the resin solids and zinc pigment not less than 80 percent of the total weight of the material.

White and color pigmented finish coats shall be an alkyd resin-based material with the resin solids and pigments not less than 85 percent of the total weight of the material. Pigments shall be heat-stable materials, formulated to colors as scheduled.

Black-pigmented finish coats shall be an alkyd resin, carbon-black pigmented material with resin solids and pigments not less than 50 percent of the total weight of the material.

Aluminum pigmented finish coats shall be an alkyd resin-based material with resin solids and pigments not less than 50 percent of the total weight of the material.

2.1.3 Category 2, 300 to 600 Degrees F

Coatings for surface temperatures not exceeding 600 degrees F shall be based on modified silicone and silicone-based resins. Coatings shall be applied in not less than two coats with a dry-film thickness of not less than 3 mils.

First coat shall be a silicone-based resin zinc-pigmented material with the resin solids and zinc pigment not less than 80 percent of the total weight of the material.

Color pigmented finish coats shall be silicone-based resin material with the resin solids and pigments not less than 80 percent of the total weight of the material. Pigments shall be heat-stable materials, formulated to colors as scheduled.

Black-pigmented finish coat shall be a silicone-based resin carbon-black pigmented material with resin solids and pigments not less than 50 percent of the total weight of the material.

Aluminum-pigmented finish coats shall be modified, silicone-based-resin material with the resin solids and pigments not less than 50 percent of the total weight of the material.

2.1.4 Category 3, 600 to 800 Degrees F

Coatings for surface temperatures not exceeding 800 degrees F shall be a modified silicone or a silicone-based material. Coatings shall be applied in not less than two coats with a dry-film thickness of not less than 3 mils.

First coat shall be a silicone-based resin, zinc-pigmented material with the resin solids and zinc pigment not less than 80 percent of the total weight of the material.

Black-pigmented finish coat shall be a silicone-based resin, carbon-black pigmented material with resin solids and pigments not less than 50 percent of the total weight of the material.

Aluminum-pigmented finish coat shall be a modified, silicone-based-resin material with the resin solids and pigments not less than 50 percent of the total weight of the material.

2.1.5 Category 4, 800 to 1,200 Degrees F

Coatings for surface temperatures not exceeding 1,200 degrees F shall be an aluminum-pigmented, silicone-resin-based material conforming to FS TT-P-28, as modified.

Coating shall be applied in not less than two coats with a dry-film thickness of not less than 2 mils.

Coating pigment shall contain a minimum of 28 percent aluminum based on the total weight of the material. Vehicle shall contain a minimum of 22 percent silicone resin and a maximum of 49 percent of volatile thinners and driers based on the total weight of the material.

2.2 EPOXY COATINGS

2.2.1 General

Epoxy coatings shall conform to MS MIL-P-24441, as modified.

Vehicle resins for finish coats shall be based on a polyamide-cured, epoxy-resin material. Finish coats shall be applied with a dry-film thickness of not less than 4 mils per coat. Finish color and gloss shall be as indicated.

2.2.2 Concrete Surface Coatings

Coatings on concrete surfaces shall be applied in not less than three coats. Prime coat shall be based on an epoxy-resin material as recommended by the coating manufacturer for the substrate to be coated and the end use of the coated surfaces. Prime coat shall fill concrete surface pores with a total film thickness of not less than 2 mils. Finish coats shall be an epoxy-based coating as specified.

2.2.3 Masonry Surfaces Coatings

Coatings on masonry surfaces shall be a masonry block filler and not less

than two finish coats. Block filler shall be based on a polyvinyl acetate or epoxy-resin material as recommended by the coating manufacturer for the substrate to be coated and the end use of the coated surface. Block filler shall fill surface pores with a total dry-film thickness of not less than 7 mils. Finish coats shall be an epoxy-based coating as specified.

2.2.4 Ferrous and Galvanized Metal Surface Coatings

Coatings on ferrous and galvanized metal surfaces shall be a prime coat and not less than two finish coats. Prime coat shall be based on an epoxy-resin material with a metallic-zinc pigment as recommended by the coating manufacturer for the substrate to be coated and the end use of the coated surface. Resin solids and zinc pigment shall not be less than 80 percent of the total weight of the coating material. Prime coat shall be applied with a total dry-film thickness of not less than 4 mils. Finish coats shall be epoxy-based coatings as specified.

2.2.5 Aluminum Surface Coatings

Coatings on aluminum surfaces shall be a prime coat and not less than two finish coats. Prime coat shall be epoxy polyamide conforming to MS MIL-P-24441/1. Prime coat shall be applied with a total dry-film thickness of not less than 4 mils. Finish coats shall be aliphatic polyurethane conforming to MS MIL-C-83286.

2.3 POLYURETHANE COATINGS

2.3.1 General

Polyurethane coatings shall conform to MS MIL-C-83286, as modified and as specified.

Vehicle resins for finish coats shall be based on a two-part, prepolymer, catalytic-cured, polyurethane material. Catalytic-cured coatings shall be applied with a total dry-film thickness of not less than 10 mils per coat. Finish color and gloss shall be as indicated on the schedules.

2.3.2 Concrete Surface Coatings

Coatings on concrete surfaces shall be applied in not less than three coats. Prime coat shall be based on a polyvinyl acetate, an epoxy-ester or a polyurethane resin material as recommended by the coating manufacturer for the substrate to be coated and the end use of the coated surfaces. Prime coat shall fill surface pores with a total dry-film thickness of not less than 2 mils. Finish coats shall be a polyurethane-based material as specified.

2.3.3 Masonry Surface Coatings

Coatings on masonry surfaces shall be a masonry block filler and not less than two finish coats. Block filler shall be based on a polyvinyl-acetate or epoxy-ester resin material as recommended by the coating manufacturer for the substrate to be coated and the end use of the coated surface. Block filler shall fill surface pores with a total film thickness of not

less than 7 mils. Finish coats shall be a polyurethane-based material as specified.

2.3.4 Ferrous and Galvanized Metal Surface Coatings

Coatings on ferrous and galvanized metal surfaces shall be applied in not less than three coats. Prime coat shall conform to MS MIL-P-24441/1 or a polyurethane-resin material as recommended by the coating manufacturer for the substrate to be coated and the end use of the coated surfaces. Prime coat shall be applied with a film thickness of not less than 2 mils. Finish coats shall be a polyurethane-based material as specified.

2.3.5 Aluminum Surface Coatings

Coatings on aluminum surfaces shall be applied in not less than three coats. Prime coat shall conform to MS MIL-P-24441/1 or a polyurethane-resin material as recommended by the coating manufacturer for the substrate to be coated and the end use of the coated surfaces. Prime coat shall be applied with a film thickness of not less than 2 mils. Finish coats shall be a polyurethane-based material as specified.

2.3.6 Wood Surface Coatings

Coatings on wood surfaces shall be applied in not less than three coats. Prime coat shall be based on a polyurethane-resin material as recommended by the coating manufacturer for the substrate to be coated and the end use of the coated surfaces. Prime coat shall be applied with a film thickness of not less than 5 mils. Finish coats shall be a polyurethane-based material as specified.

2.4 CHLORINATED-RUBBER COATINGS

2.4.1 General

Vehicle resins for finish coats shall be based on a modified, chlorinated-rubber, phenolic-resin material. Coating material shall contain not less than 20 percent chlorinated rubber resin, based on the total weight of the material. Finish coats shall be applied with a dry-film thickness of not less than 3-mils per coat. Finish coating color shall be as indicated.

2.4.2 Concrete Surface Coatings

Coatings on concrete surfaces shall be applied in not less than three coats. Prime coat shall be based on a chlorinated-rubber resin material as recommended by the coating manufacturer for the substrate to be coated and the end use of the coated surfaces. Prime coat shall fill concrete surface pores with a total film thickness of not less than 2 mils. Finish coats shall be chlorinated-rubber-based coatings as specified.

2.4.3 Masonry Surface Coatings

Coatings on masonry surfaces shall be a masonry block filler and not less than two finish coats. Block filler shall be based on an epoxy-ester resin

material as recommended by the coating manufacturer for the substrate to be coated and the end use of the coated surface. Block filler shall fill surface pores with a total film thickness of not less than 7 mils. Finish coats shall be chlorinated-rubber-based coatings as specified.

2.4.4 Ferrous and Galvanized Metal Surface Coatings

Coatings on ferrous and galvanized metal surfaces shall be a prime coat and not less than two finish coats. Prime coat shall conform to MS MIL-P-24441/1, with a pigment as recommended by the coating manufacturer for the substrate to be coated and the end use of the coated surface. Prime coat shall be applied with a dry-film thickness of not less than 3 mils. Finish coats shall be chlorinated rubber-based coatings as specified.

2.4.5 Aluminum Surface Coatings

Coatings on aluminum surfaces shall be a prime coat and not less than two finish coats. Prime coat shall conform to MS MIL-P-24441/1 or a modified, chlorinated-rubber, alkyd-resin material with pigment as recommended by the coating manufacturer for the substrate to be coated and end use of the coated surface. Finish coats shall be chlorinated-rubber-based coatings as specified.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

3.1.1 Concrete Surfaces

Concrete surfaces scheduled to be coated shall be free of dirt, dust, oil, grease, efflorescence, loose chalk and other loose material, or foreign matter that might interfere with the coating bond.

Form oil, grease, and other oily contaminants shall be removed by scrubbing the surface with a trisodium phosphate and water solution. After cleaning, the surface shall be treated with a 5 percent to 10 percent solution of muriatic acid to etch the surface. After application, surfaces shall be neutralized and washed down with clean water.

Efflorescence shall be removed, before painting, by wire brushing and applying a 5- to 10-percent solution of muriatic acid. After application, surfaces shall be neutralized and washed down with clean water.

Large cracks, holes, and other damaged areas shall be patched with a cement-sand grout. Grout shall be allowed to age for not less than 14 calendar days before application of coatings.

3.1.2 Masonry Surfaces

Masonry surfaces scheduled to be coated shall be free of dirt, dust, oil, grease, efflorescence, loose chalk and other loose material, or foreign matter which may interfere with the coating bond.

3.1.3 Ferrous Metals

Ferrous metals shall be cleaned in accordance with SSPC SP 5 using wet-sand blasting or vacuum-blast cleaning equipment. Surfaces shall be primed promptly after cleaning.

After cleaning, ferrous surfaces shall be coated with an epoxy coating conforming to MS MIL-P-24441.

3.1.4 Galvanized Surfaces

Galvanized surfaces scheduled to be painted shall be solvent cleaned in accordance with SSPC SP 1. Rusted and highly soiled surfaces shall be cleaned in accordance with SSPC SP 2 or SSPC SP 3. Care shall be taken not to damage or remove galvanizing.

After cleaning, galvanized surfaces shall be treated with a metal pretreatment coating applied in accordance with SSPC Paint 27 and coated with an epoxy coating conforming to MS MIL-P-24441.

3.1.5 Aluminum Surfaces

Aluminum and aluminum-alloy surfaces scheduled to be painted shall be solvent cleaned to remove oil, grease, soil, and other foreign matter. Soiled surfaces shall be cleaned with a stiff bristle brush or aluminum wool.

After cleaning, aluminum surfaces shall be coated with an epoxy coating conforming to MS MIL-P-24441.

3.1.6 Wood Surfaces

Exterior wood surfaces shall be clean and dry before application of coatings. Cracks and nail holes shall be filled with putty or plastic wood after priming.

Surfaces shall be brushed, scraped, sanded, and cleaned as may be required to produce a surface free of dust, dirt, oil, grime, sap streaks, splinters, projections, and rough areas. Exposed knots shall be cleaned and sealed with a knot sealer before painting.

Interior wood surfaces shall be clean and dry before application of coatings. Nails shall be countersunk and the nail holes filled with putty or plastic wood after priming.

Surfaces finished with pigmented coatings shall be finished smooth with Grade 0 or finer sandpaper. Sanding shall be done in the direction of the wood grain.

Surfaces finished with transparent coatings shall be finished smooth with Grade 00 or finer sandpaper. Sanding shall be done in the direction of the wood grain.

Loose dirt, dust, and sandings shall be completely removed by brushing, vacuum cleaner, tack rag, or other approved method before application of

finish coatings.

3.2 COATING MATERIAL PREPARATION

3.2.1 General

Coating materials shall be mixed and prepared in accordance with the coating manufacturer's directions for the particular material and coat to be applied. Materials which are not in actual use shall be kept in closed containers.

Coating materials that have been mixed with an automatic shaker shall be allowed to stand to let air bubbles escape, then given a final hand mixing before application. Materials shall be stirred so as to produce a mixture of uniform density and shall be stirred at frequent intervals during application to prevent skinning. Film which may form on the surface of the material shall not be stirred into the material. Film shall be removed and strained, if necessary.

3.2.2 Thinning

Thinning shall be done in accordance with coating manufacturer's directions for the particular material and coat.

3.2.3 Tinting

Prime and intermediate coats of paint shall be a slightly different tint from the finish coat to facilitate identification of each coat. Tinting shall be done by the coating manufacturer and clearly identified as to color and coat.

3.3 APPLICATION OF COATING MATERIALS

3.3.1 General

Exterior painting shall not be performed in damp or rainy weather. Interior painting shall not be allowed until the building is enclosed and has thoroughly dried out. No painting will be allowed below 50 degrees F and above 95 degrees F. Painting application shall be in accordance with the coating manufacturer's recommendations, and as specified.

Application of coatings shall be done by skilled applicators. Coatings shall be applied to clean and properly prepared surfaces. Coatings shall be applied carefully with clean, high-quality application equipment. Sufficient time shall be allowed between coats to ensure complete drying and curing. Surfaces shall be sanded and dusted between coatings, as required, to produce a surface free of visible defects. High gloss coatings and clear finishes shall be lightly sanded between coats to ensure bond of following coats.

Coats shall be applied to the surfaces in an even film. Cloudiness, spotting, holidays, laps, application marks, runs, sags, and other similar surface imperfections will not be acceptable. Defective coating applications shall be removed and recoated as directed.

Coating lines such as wainscots shall be sharp, true, and well-defined. Tape may be used to establish coating lines, providing tape is removed before ragging or sawtooth edges form.

Surfaces, including edges, corners, crevices, welds, and other similar changes in surface plane, shall receive a dry-film thickness not less than specified.

3.3.2 Brush Application

Brushes shall be clean and the proper size and type for high-quality application of the specified coating materials. Slow-dry coatings shall be brushed out. Quick-dry coatings shall be brushed only enough to spread out evenly.

3.3.3 Roller Application

Roller covers shall be clean and of the proper nap length, nap texture, and material for high-quality application of the specified coating materials.

Roller application shall be done carefully and shall be equivalent in all respects to the same coats applied by high-quality brush application.

3.3.4 Spray Application

Spray application equipment shall be limited to airless-spray equipment and electrostatic-spray equipment. Equipment shall be clean and operated by workmen skilled in high quality application of coating materials.

Spray application of coatings shall be limited to finish coats on metal frame works, siding, decking, wire mesh, and other surfaces where hand work would be inferior. Sprayed coatings shall be carefully applied and equivalent in all respects to the same coats applied by high quality brush application. Each spray coat shall be permitted to cure before the succeeding coat is applied. Doubling back with application equipment, for the purpose of building up film thickness of two coats in one operation, will not be permitted.

Surfaces adjacent to areas to be spray coated shall be covered to prevent damage from overspray, coating rebound, and spray drift.

3.4 ACCEPTANCE PROVISIONS

3.4.1 Repairing

Damaged and unacceptable portions of completed work shall be removed and replaced with new work to match adjacent surfaces at no additional cost to the Government.

3.4.2 Cleaning

Surfaces of the work, and adjacent surfaces soiled as a result of the work, shall be cleaned. Equipment, surplus materials, and rubbish from the work shall be removed from the site.

-- End of Section --

SECTION 09986

FIBERGLASS REINFORCED PLASTIC PANELS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.2 DESCRIPTIONS

This Section describes the requirements for furnishing and installing fiberglass reinforced plastic panels with and without substrate backer according to manufacturer's recommendations. See Drawings for location.

1.3 SUBMITTALS

Hi-lite all descriptive literature to accomplish identification of specific components/items which are proposed to be furnished. Government will not react to descriptive material/literature which has not been hi-lited, except to reject the Submittal.

Two samples of each type of panel, each type of trim and fastener.

Shop Drawings: Indicate the location and dimension of joints and fastener attachments.

SD-12 LEED Submittals per Section 01352

1. Credit EQ 4.1: Manufacturer's product data for adhesives and sealants, including printed statement of VOC content.

1.4 QUALITY ASSURANCE

Provide panels and molding only from the manufacturer specified to ensure warranty and color harmonization of accessories.

1.5 DELIVERY, STORAGE, AND HANDLING

Delivery of Materials: Package sheets on skids or pallets for shipment to project site.

Storage of Materials: Store panels in a dry place at the project site.

Handling: Remove foreign matter from face of panel by use of a soft bristle brush, avoiding abrasive action.

1.6 PROJECT CONDITIONS

Installation shall not begin until building is enclosed, permanent heating

and cooling equipment is in operation, and residual moisture from plaster, concrete or terrazzo work has dissipated.

During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.

Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

PART 2 PRODUCTS

For design purposes, an FRP panel manufacturer and color have been chosen. See Sheet A5.1.

2.1 MATERIALS

Class III (C) Interior Finish: Panel thickness shall be nominal. 03-inch for use as general purpose wall application (embossed finish).

Independent laboratory ASTM E-84 testing.

Flame Spread of 200 or lower; Smoke Developed of 450 or lower per ASTM E-84 latest version.

Barcol Hardness (scratch resistance) of 42 as per ASTM E-2583.

Panels will exhibit no more than a 0.038 percent weight loss after a 25-cycle Taber Abrasion Test.

Gardner Impact Strength of 16 in. lbs.

Meets USDA / FSIS Guidelines.

ICBO Report Number 4583.

A means of frontside identification and confirmation of meeting Class III (C) interior finish requirements after installation and while in service without labels.

2.2 MANUFACTURERS

Products: Subject to compliance with requirements, provide one of the products indicated or an equal approved by the Contracting Officer.

Kemlite Company.

Moldings:

Harmonizing PVC (polyvinylchloride) moldings shall match the color of the FRP panel.

Sealant: Optional. Specify joints as sealed with a high quality clear silicone sealant in food preparation, storage, or process areas, areas of high moisture, and in areas where steam cleaning occurs.

Rivets: Optional. Specify rivets in harmonizing colors (by color name and number) in areas where there are wide changes in temperature or humidity, where the substrate is unusually uneven, and in all low temperature or cold storage applications.

Laminate FRP Panel: Kemlite, Color: White.

Composition:

Surface (Glasbord FRP panel):

- 1) Reinforcement: Fiberglass, random chopped.
- 2) Resin Mix: Polyester/styrene copolymer and inorganic fillers and pigments.

Adhesive: Polyurethane. All adhesives must comply with VOC limits set forth in Section 01352 "LEED Requirements."

Finished Panel Quality:

The Glasbord FRP laminate shall not delaminate from the substrate when edges are securely fastened to an adequate structural system, and when joints and edges are protected with a permanently flexible thiokol or silicone-like caulking compound and suitable vinyl or metal (aluminum or stainless steel) division bars. Alignment between Glasbord FRP laminate and substrate will be to +0, -3/32-inch on any edge.

Adhesive squeeze-out on any panel will not exceed 1/32-inch on any edge.

The color of the Glasbord FRP laminate shall be a uniform white as specified.

Panel weight will vary as a function of substrate thickness, density, and moisture content.

Dimensional tolerances will be: Length and width +0, -1/16-inch, squareness 1/16-inch in 48-inches.

PART 3 EXECUTION

3.1 INSTALLATION

Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.

Do not begin installation until backup surfaces are put into satisfactory condition.

3.2 PREPARATION

Do all cutting with carbide tipped saw blades or drill bits, or cut with snips.

Install panels with manufacturer's recommended gap for panel field and corner joints.

Fastener holes in the panels must be predilled 1/8-inch oversize.

For trowel type and application of adhesive, follow adhesive manufacturer's recommendation.

Using products acceptable to manufacturer, install the FRP panel system in accordance with panel manufacturer's printed instruction.

3.3 CLEANING

Remove any adhesive or excessive sealant from panel face using solvent or cleaner recommended by panel manufacturer.

-- End of Section --

SECTION 10160

METAL TOILET COMPARTMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ALUMINUM ASSOCIATION (AA)

AA 45 (2003) Designation System for Aluminum Finishes

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M (2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 336/A 336M (2003a) Standard Specification for Steel Forgings, Alloy, for Pressure and High-Temperature Parts

ASTM A 385 (2003) Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)

ASTM A 525 (1993) Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

ASTM A 526/A 526M (1990) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality

ASTM B 456 (2003) Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium

ASTM D 2092 (1995; R 2001e1) Standard Practice for Preparation of Zinc-Coated Galvanized Steel Surfaces for Paint

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS FF-B-588 (Rev D) Bolt, Toggle; and Expansion Sleeve, Screw

FS FF-S-325 (Int Amd 3) Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices,

Anchoring, Masonry)

1.2 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Fabrication Drawings shall be submitted in accordance with paragraph entitled, "General Information," of this section.

Installation Drawings shall be submitted for metal toilet partitions and urinal screens in accordance with the paragraph entitled, "Installation," of this section.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

- Galvanized Steel Sheet
- Sound Deadening Cores
- Partition Panels and Doors
- Anchoring Devices and Fasteners
- Hardware and Fittings
- Brackets
- Door Hardware
- Ceiling-Hung Partitions
- Floor-Supported Partitions
- Overhead-Braced Partitions

SD-04 Samples

Three samples of fabrication of Partition Panels showing a finished edge on two adjacent sides and core construction, each not less than 12-inches square

Three of each item of Hardware and Fittings and Anchoring Devices and Fasteners

Approved hardware samples may be installed in the work if properly identified.

SD-07 Certificates

Certification of product quality shall be provided by the

Contractor in accordance with paragraph entitled, "Quality Assurance," of this section.

SD-12 LEED Submittals per Section 01352

1. Credit MR 4.1 and 4.2: List of proposed materials with recycled content.
 - a. Indicate cost, post-consumer recycled content, and post-industrial recycled content for each product having recycled content.

1.4 DELIVERY, HANDLING, AND STORAGE

Materials shall be protected from weather, soil, and damage during delivery, storage, and construction.

Materials shall be delivered in the original, unopened packages or containers bearing the brand name and the name of the material.

1.5 FIELD MEASUREMENTS

Field measurements shall be taken prior to the preparation of drawing and fabrication to ensure proper fits.

1.6 GENERAL INFORMATION

Fabrication Drawings shall be submitted for metal toilet partitions and urinal screens consisting of fabrication and assembly details to be performed in the factory.

1.7 QUALITY ASSURANCE

Certification that metal toilet partitions will be free of defects in materials, fabrication, finish, and installation and will remain so for a period of not less than 5 years after completion.

PART 2 PRODUCTS

For design purposes, a metal toilet compartment color has been chosen and is located on Sheet A5.1.

2.1 GALVANIZED STEEL SHEET

Galvanized steel sheet shall be cold-rolled, stretcher-level, commercial quality material conforming to ASTM A 526/A 526M with zinc coating conforming to ASTM A 525, G90. Surface preparation of material for painting shall conform to ASTM D 2092, Method A.

2.2 SOUND-DEADENING CORES

Sound deadening shall consist of treated kraft paper honeycomb cores with a cell size of not more than 1 inch. Resin-material content shall weigh not less than 11 percent of the finished core weight. Expanded cores shall be faced on both sides with kraft paper.

2.3 PARTITION PANELS AND DOORS

Partition Panels and doors shall be not less than 1 inch thick with face sheets not less than 0.0396 inch thick.

2.4 PARTITION FABRICATION

Partition Panels, doors, screens, and pilasters required for the project shall be fabricated from galvanized-steel face sheets with formed edges. Face sheets shall be pressure-laminated to the sound-deadening core with edges sealed with a continuous locking strip and corners mitered and welded. Welds shall be ground smooth. Concealed reinforcement shall be provided for installation of hardware, fittings, and accessories. Surface of face sheets shall be smooth and free from wave, warp, or buckle.

2.5 PREPARATION

Before application of an enamel coating system, galvanized-steel surfaces shall be solvent-cleaned to remove processing compounds, oils, and other contaminants harmful to coating-system adhesion. After cleaning, the surfaces shall be coated with a metal-pretreatment phosphate coating. After pretreatment, exposed galvanized-steel surfaces shall be finished with a baked-enamel coating system as specified.

2.6 ENAMEL COATING SYSTEM

Enamel coating system shall consist of a factory-applied baked acrylic enamel coating system. Coating system shall be a durable, washable, stain-resistant, mar-resistant finish.

2.7 ANCHORING DEVICES AND FASTENERS

Steel anchoring devices and fasteners shall be hot-dipped galvanized after fabrication in conformance with ASTM A 385 and ASTM A 123/A 123M. Galvanized anchoring devices shall be concealed. Toggle bolts shall conform to FS FF-B-588. Masonry anchors shall conform to FS FF-S-325. Exposed fasteners shall have one-way heads.

2.8 HARDWARE AND FITTINGS

2.8.1 Materials

Cold-rolled sheet steel shall conform to ASTM A 336/A 336M, commercial quality.

2.8.2 Finishes

Chrome plating shall conform to ASTM B 456.

Aluminum shall have a clear anodic coating conforming to AA 45.

2.9 BRACKETS

Wall brackets shall be two-ear panel brackets, T-style, 1-inch stock.

Panel-to-pilaster brackets shall be stirrup style.

2.10 DOOR HARDWARE

Hinges shall be self-lubricating with the indicated swing.

Hinges shall be the cutout-insert type have the following type of return movement:

Spring-action cam return movement

Hinge shall be adjustable to hold in-swinging doors open at any angle up to 90 degrees and outswinging doors to 10 degrees.

Latch and pull shall be a combination rubber-faced door strike and keeper equipped with emergency access.

Coat hooks shall be combination units with hooks and rubber tipped pins.

2.11 FLOOR-SUPPORTED PARTITIONS

Pilasters shall be not less than 1-1/4 inches thick with face sheets not less than 0.0635 inch thick. Anchoring device at the bottom of the pilaster shall consist of a steel bar not less than 1/2- by 7/8-inch welded to the reinforced face sheets and shall have not less than two 3/8-inch round anchorage devices for securing to the floor slab. Anchorage devices shall be complete with threaded rods, expansion shields, lock washers, and leveling-adjustment nuts. Trim piece at the floor shall be 3 inches high and fabricated from not less than 0.030-inch thick corrosion-resistant steel.

2.12 OVERHEAD-BRACED PARTITIONS

Pilasters shall be not less than 1-1/4 inches thick with face sheets not less than 0.0396 inch thick. Anchoring device at the bottom of the pilaster shall consist of a channel-shaped floor stirrup fabricated from not less than 0.0635-inch thick material and a leveling bolt. Stirrup shall be secured to the pilaster with not less than a 3/16-inch bolt and nut after the pilaster is leveled. Stirrup shall be secured to the floor with not less than two lead expansion shields and sheetmetal screws. Overhead brace shall be fabricated from a continuous extruded aluminum tube not less than 1 inch wide by 1-1/2 inches high, 0.125-inch wall thickness. Finish shall be AA-C22A31 in accordance with AA 45. Brace shall be set and secured into the top of each pilaster. Trim piece at the floor shall be 3 inches high and fabricated from not less than 0.030-inch thick corrosion-resistant steel.

2.13 SCREENS

2.13.1 Urinal Screens

Screens shall be fabricated from the same types of panels and pilasters as

the toilet partitions. Fittings and fasteners shall be corrosion-resistant steel.

Screens shall be wall hung with flanges.

PART 3 EXECUTION

3.1 INSTALLATION

Partitions shall be installed rigid, straight, plumb, and level, with the panels centered between the fixtures. Contractor shall provide a panel clearance of not more than 1/2 inch and shall secure the panels to walls and pilasters with not less than two wall brackets attached near the top and bottom of the panel. Wall brackets shall be located so that holes for wall bolts occur in masonry or tile joints. Panels shall be secured to pilasters with brackets matching the wall brackets.

Panels shall be secured to hollow plastered walls with toggle bolts using not less than 1/4-20 screws of the length required for the wall thickness. Toggle bolts shall have a load-carrying strength of not less than 600 pounds per anchor.

Panels shall be secured to ceramic tile on hollow plastered walls or hollow concrete-masonry walls with toggle bolts using not less than 1/4-20 screws of the length required for the wall thickness. Toggle bolts shall have a load-carrying strength of not less than 600 pounds per anchor.

Installation Drawings shall be submitted for metal toilet partitions and urinal screens. Drawings shall indicate the type of partition, location, mounting height, cutouts, and reinforcement required for toilet-room accessories.

3.2 FLOOR-SUPPORTED PARTITIONS

Pilasters shall be secured to the floor with the anchorage device specified. Leveling device shall be readily accessible for leveling, plumbing, and tightening the installation. Tops of doors shall be level with tops of pilasters when doors are in a closed position. Expansion shields shall have a minimum 2-inch penetration into the concrete slab.

3.3 OVERHEAD-BRACED PARTITIONS

Pilasters shall be secured to the floor with the anchorage device specified. Leveling device shall be readily accessible for leveling, plumbing, and tightening the installation. Overhead brace shall be secured to the pilaster face with not less than two fasteners per face. Expansion shields shall have a minimum 2-inch penetration into the concrete slab.

Tops of doors shall be parallel with the overhead brace when doors are in a closed position.

3.4 FINAL ADJUSTMENTS

After completion of the installation, the Contractor shall make final

adjustments to the pilaster-leveling devices, door hardware, and other working parts of the partition assembly.

3.5 CLEANING

Surfaces of the work and adjacent surfaces soiled as a result of the work shall be cleaned in an approved manner. Equipment, surplus materials, and rubbish from the work shall be removed from the site.

-- End of Section --

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SECTION 10260

WALL AND CORNER GUARDS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any), apply to the work specified in this Section.

Section 01352 "LEED Requirements."

1.2 DESCRIPTION OF WORK

The following type of application is specified in this Section:

Corner guards.

1.3 QUALITY ASSURANCE

Products: Provide corner guards as manufactured by the following or equal:

Construction Specialties, Muncy, Penn. (C/S Acrovyn)
Koroguard

1.4 SHOP DRAWINGS

Submit Shop Drawings for the fabrication, maintenance, and installation of corner guard. Include details of type, and installation instructions. Show anchorage and accessory items.

1.5 QUALITY ASSURANCE

Installer Qualifications: Engage an installer who has no less than 3 years experience in installation of systems similar in complexity to those required for this project.

Manufacturer's Qualifications: Not less than 5 years experience in the production of specified products and a record of successful in-service performance.

Code Compliance: Assemblies should conform to all applicable codes including IBC, UBC, SBCCI, BOCA, and Life Safety.

Fire Performance Characteristics:

Provide PVC-free thermoplastic wall protection system components with UL label indicating that they are identical to those tested in accordance with ASTM-E84-01 for Class 1 characteristics listed below (specify for SM-20AE and SM20ME only):

Flame Spread: 25 or less.
Smoke Developed: 450 or less.

Impact Strength: Provide assembled wall protection units that have been tested in accordance with the applicable provisions of ASTM F476076.

Chemical and Stain Resistance: Provide wall protection system components with chemical and stain resistance in accordance with ASTM D-1308.

Single Source Responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the project site in unopened original factory packaging clearly labeled to show manufacturer.

Store materials in original, undamaged packaging in a cool, dry place out of direct sunlight and exposure to the elements. A minimum room temperature of 40 deg F and a maximum of 100 deg F should be maintained.

Material must be stored flat.

1.7 PROJECT CONDITIONS

Materials must be acclimated in an environment of 65 deg F - 75 deg F for at least 24 hours prior to beginning the installation.

Installation areas must be enclosed and weatherproofed before installation commences.

1.8 SAMPLES

Submit samples of each color. Architect's review of samples will be for color, texture and pattern only.

1.9 SUBMITTALS

SD-12 LEED Submittals per Section 01352

1. Credit EQ 4.1: Manufacturer's product data for adhesives, including printed statement of VOC content.
2. Credit MR 4.1 and 4.2: List of proposed materials with recycled content.
 - a. Indicate cost, post-consumer recycled content, and post-industrial recycled content for each product having recycled content.

1.10 PRODUCT DELIVERY, STORAGE AND HANDLING

Deliver corner guards cartoned to provide protection during transit and job storage.

PART 2 PRODUCTS

For design purposes, a manufacturer, product, and colors have been chosen. See Sheet A5.1 for information.

2.1 MATERIALS

PVC-Free Thermoplastic: Extruded material should be high impact with pebblette texture, 0.078 inch thickness or greater. Chemical and stain resistance should be per ASTM D-1308. Standards as established by the manufacturer. Shall be completely recyclable and UL Class 1 fire-rated. Size should be 4 foot from top of wall base.

Aluminum Retainers: Extruded aluminum retainers should be 6063-T6 alloy, 0.063 inch thickness. Minimum strength and durability properties as specified in ASTM B221.

Fasteners: All fasteners to be non-corrosive and compatible with aluminum retainers. All necessary fasteners to be supplied by the manufacturer.

2.2 CORNER GUARDS

PVC-Free Thermoplastic Corner Guards: Surface mounted guards consisting of a continuous retainer with snap-on cover. Color matched end caps to be provided for both partial and full height applications. Attachment hardware shall be appropriate for wall construction.

Surface mounted corner guard with 3 inch legs, 1/4 inch radiused cover and aluminum retainer.

2.3 FABRICATION

General: Fabricate wall protection systems to comply with requirements indicated for design, dimensions, detail, finish and member sizes.

PART 3 EXECUTION

3.1 EXAMINATION

Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

Surface Preparation: Prior to installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer's instructions.

Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.

3.3 INSTALLATION

Install the work of this section in strict accordance with the manufacturer's recommendations, using only approved mounting hardware, and locating all components firmly into position, level and plumb.

Temperature at the time of installation must be between 65 deg F - 75 deg F and be maintained for at least 48 hours after the installation.

Adjust installed end caps as necessary to ensure tight seams.

3.4 CLEANING

General: Immediately upon completion of installation, clean vinyl covers and accessories in accordance with manufacturer's recommended cleaning method.

Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

3.5 PROTECTION

Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

-- End of Section --

SECTION 10425

SIGNS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

Section 01352 "LEED Requirements."

1.2 SUMMARY

This Section includes panel signs for all rooms in new and existing portions of the building at all interior 3'-0" x 7'-0" doors and pairs of doors. Remove all existing signs where occurs.

1.3 SUBMITTALS

Product Data: Include manufacturer's construction details relative to materials, dimensions of individual signs and components, profiles and finishes for each type of sign required.

Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.

Samples for initial selection of color, pattern and texture:

Cast Acrylic Sheet and Plastic Laminate: Manufacturer's color charts consisting of actual sections of material including the full range of colors available for each material required.

SD-12 LEED Submittals per Section 01352

1. Credit MR 4.1 and 4.2: List of proposed materials with recycled content.
 - a. Indicate cost, post-consumer recycled content, and post-industrial recycled content for each product having recycled content.
2. Credit EQ 4.1: Manufacturer's product data for adhesives and sealants, including a printed statement of VOC content.
3. Credit EQ 4.4: Composite wood manufacturer's product data for each composite wood product used indicating that the bonding agent used contains no urea formaldehyde.

1.4 QUALITY ASSURANCE

Single-Source Responsibility: Obtain signs from a single manufacturer.

Signage to conform to AFP 88-40 Sign Standards, Type BB3.

PART 2 PRODUCTS

For design purposes a signage color and manufacturer was chosen and is located in the Structural Interior Design Manual (SID) Color Guide Specifications.

2.1 MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products of one of the following:

Andco Industries Corp.
APPCO Signage, Inc.
Innerface Architectural Signage, Inc.
ASI Sign Systems, Inc.
Best Manufacturing Co.
Modulex
Mohawk Sign Systems
Spanjer Brothers, Inc.
The Supersine Company
Vomar Products, Inc.
or approved equal.

2.2 MATERIALS

Cast Acrylic Sheet: Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thickness indicated, with a minimum flexural strength of 16,000 psi when tested in accordance with ASTM D 790, a minimum allowable continuous service temperature of 176 deg. F., and of the following general types:

Transparent Sheet: Where sheet material is indicated as "clear", provide colorless sheet in matte finish, with light transmittance of 92 percent, when tested in accordance with the requirements of ASTM D 1003.

White Translucent Sheet: Where sheet material is indicated as "white", provide white translucent sheet of density required to produce uniform brightness and minimum halation effects.

Opaque Sheet: Where sheet material is indicated as "opaque", provide colored opaque acrylic sheet in colors and finishes indicated.

Fasteners: Use concealed fasteners or adhesives as recommended by manufacturer for the sign material and mounting surface.

Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background colors, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for the application intended.

2.3 PANEL SIGNS

Panel Signs: Provide nominal size 6" x 9" x 1/8" thick. Sign to be manufactured from 1/16" clear matte acrylic, subsurface screen printing for both symbol and background color, laminated to 1/4" base plate. Mount centered in door at 5'-6" high to top of door.

Colors to be similar to one chosen in Structural Interior Design Manual (SID) Color Guide Specifications.

Provide radiused corners with beveled edge condition.

Edges : Square
Total Thickness: 1/8" thick
Character Font: Match Base Standard

Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16" measured diagonally.

PART 3 EXECUTION

3.1 INSTALLATION

General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.

Install signs level, plumb and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

Mount Panel Signs: Double-sided vinyl foam tape.

3.2 CLEANING AND PROTECTION

At completion of the installation, clean soiled sign surfaces in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Contracting Officer.

-- End of Section --

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SECTION 10500

LOCKERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ASTM INTERNATIONAL (ASTM)

ASTM A 366/A 366M	(1997e1) Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality
ASTM A 525	(1993) Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A 526/A 526M	(1990) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality
ASTM A 568/A 568M	(2003) Standard Specifications for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for
ASTM B 456	(2003) Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
ASTM D 2092	(1995; R 2001e1) Standard Practice for Preparation of Zinc-Coated Galvanized Steel Surfaces for Paint

U.S. DEPARTMENT OF DEFENSE (DOD)

MS MIL-C-22750	(1992e) Coating, Epoxy, High Solids
MS MIL-C-22751	(Rev D; Notice 1) Coating System, Epoxy-Polyamide, Chemical and Solvent Resistant, Process for Application of
MS MIL-P-23377	(1989f) Primer Coatings: Epoxy, Chemical and Solvent Resistant

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS AA-L-00486	(1993j) Lockers, Clothing, Steel
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1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

The following drawings shall be submitted in accordance with paragraph entitled, "General Information," of this section.

Fabrication Drawings
Installation Drawings

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items, including material qualities, locking devices, handles, finish assembly instructions, and other similar items.

A lock-control chart shall be submitted showing each lock required for the project, the locker identification plate number, and the lock combination or lock key number.

Locker Materials
Hardware and Accessories

SD-04 Samples

Three Color Chips, not less than 12-inches square, of each color schedule shall be submitted.

SD-07 Certificates

Certificates shall be submitted in accordance with paragraph entitled, "General Information," of this section.

1.3 DELIVERY, HANDLING, AND STORAGE

Materials shall be protected from weather, soil, and damage during delivery, storage, and construction.

Materials shall be delivered in their original packages, containers, or bundles bearing the brand name and the name of the material.

1.4 FIELD MEASUREMENTS

To ensure proper fits, field measurements shall be taken prior to the preparation of drawings and fabrication.

1.5 FIELD TESTS

Government may request performance-characteristic tests on assembled

lockers. Tests and results shall conform to FS AA-L-00486. Lockers not conforming will be rejected.

1.6 LOCKER TYPES

Locker shall be the following type and size in the location and quantities indicated. Locker finish colors shall be as scheduled.

1.7 SINGLE-TIER LOCKERS

Single-tier lockers shall be as follows:

Type STL-1: Single-tier locker 16 inches wide, 16 inches deep, and 72 inches high, attached to 6-inch high base

1.8 GENERAL INFORMATION

Fabrication Drawings shall be submitted for lockers consisting of fabrication and assembly details to be performed in the factory.

Installation Drawings shall be submitted for lockers indicating the locker type required, location, locker-number sequence, and installation details.

Certificates showing Lockers will be free of defects in materials, fabrication, finish, and installation, and that they will remain so for a period of not less than 5 years after completion.

Three Color Chips, not less than 12-inches square, of each color schedule shall be submitted.

PART 2 PRODUCTS

2.1 LOCKER MATERIALS

2.1.1 Steel Sheet

Steel sheet used for the fabrication of lockers shall be cold-rolled, commercial-quality material conforming to ASTM A 366/A 366M and ASTM A 568/A 568M. Sheet thickness shall be as specified. Surface preparation and phosphate pretreatment of material shall be provided as required for subsequent finishing.

2.1.2 Galvanized Steel Sheet

Galvanized steel sheet used for fabrication of lockers shall be hot-dipped commercial quality minimized spangle material conforming to ASTM A 526/A 526M with not less than a 1.25-ounce zinc coating conforming to ASTM A 525.

Surface preparation of material for finishing shall conform to ASTM D 2092, Method A. Sheet thickness indicated shall be the uncoated sheet-steel thickness.

2.1.3 Chromium Coating

Chromium coating shall be nickel and chromium electrodeposited on the

specified base metal. Coating shall conform to ASTM B 456, SC-3, as applicable to the base metal.

2.1.4 Locker Finish

Primer shall conform to MS MIL-P-23377 and topcoat as specified in MS MIL-C-22750. Application shall conform to MS MIL-C-22751. Color shall be as indicated on the finish schedule.

2.2 LOCKER FABRICATION

Hardware and Accessories for locker fabrication and construction shall meet all design specifications for referenced standards within this section.

2.2.1 Locker Bodies

Locker-body fabrication including the back, sides, top, and bottom shall conform to FS AA-L-00486 and as herein modified. Locker bodies shall be fabricated from not less than 0.0239-inch thick steel sheet.

2.2.1.1 Sloping Locker Tops

Sloping locker tops shall be provided in addition to the locker-section flat tops. Sloping tops shall be continuous in length. Fillers or closures shall be provided at the exposed end of sloping tops. Sloping tops shall be fabricated from not less than 0.0478-inch thick steel sheet.

2.2.1.2 Closed Locker Bases

Closed locker base shall be 6 inches high with edges flanged inward. Bases shall be continuous in length and placed in a plane flush with the locker surfaces. Bases shall be provided for all surfaces exposed-to-view. Closed locker bases shall be fabricated from not less than 0.0598-inch thick steel sheet.

2.2.1.3 Locker Finish

Application of the locker finish, including surface preparation, priming, and enameling, shall conform to FS AA-L-00486.

2.2.2 Doors, Door Frames, and Door Louvers

Doors, door frames, and door louvers shall conform to FS AA-L-00486 as herein modified. Doors, door frames, and door louvers shall be fabricated from not less than 0.0598-inch thick steel sheet.

2.2.3 Latch Strikes

Latch strikes shall conform to FS AA-L-00486 as herein modified. Latch strikes shall be fabricated from not less than 0.0747-inch thick steel sheet.

2.2.4 Shelves

Shelves shall conform to FS AA-L-00486 as herein modified. Shelves shall be fabricated from not less than 0.0359-inch thick steel sheet.

2.2.5 Hinges

Hinges shall conform to FS AA-L-00486 as herein modified. Hinges shall be not less than the 5-knuckle type welded to the door frame and bolted to the door. Hinges shall be fabricated from not less than 0.0747-inch thick steel sheet.

2.2.6 Latching Mechanisms

Latching mechanisms shall conform to FS AA-L-00486.

2.2.7 Door Handles

Door handles shall conform to FS AA-L-00486 as herein modified. Zinc alloy or steel handles shall have a chromium coating as specified.

2.2.8 Built-in Locks

Built-in key locks shall conform to FS AA-L-00486 as herein modified. Dead bolt shall be cast-brass alloy. Tumblers shall be 5-disk or 5-pin type. Provide two keys for each lock and three master keys. Keys shall be delivered in a key case with each key set identified by lock and locker number.

Built-in combination locks shall conform to FS AA-L-00486 as herein modified. Combination locks shall be master key controlled. Three master keys shall be delivered in a key case.

2.2.9 Coat Hooks

Coat hooks shall conform to FS AA-L-00486. Hooks shall be chromium coated.

2.2.10 Hanger Rods

Hanger rods shall conform to FS AA-L-00486.

2.2.11 Number Plates

Number plates shall conform to FS AA-L-00486.

2.2.12 Label Holders

Label holders shall conform to FS AA-L-00486.

2.2.13 Fastening Devices

Fastening devices shall conform to FS AA-L-00486.

PART 3 EXECUTION

3.1 ASSEMBLY

Lockers shall be assembled according to the locker manufacturer's instructions.

Lockers shall be carefully assembled, lined up horizontally and vertically, and rigidly screwed to the base and wall. Adjacent lockers shall be bolted together.

Doors shall be adjusted to operate freely without sticking or binding and shall close tightly.

3.2 ACCEPTANCE PROVISIONS

3.2.1 Repairing

Damaged and unacceptable portions of completed work shall be removed and replaced with new work at no additional cost to the Government.

3.2.2 Cleaning

Surfaces of the work, and adjacent surfaces soiled as a result of the work, shall be cleaned in an approved manner. Equipment, surplus materials, and rubbish from the work shall be removed from the site.

-- End of Section --

SECTION 10520

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

The materials of this Section are part of the overall requirements to comply with the specified level certification of the "Leadership in Energy and Environmental Design" or LEED Green Building Rating System, Version 2.1. The materials to be provided are to meet the guidelines for selection, as available and as part of the total package developed, as defined in Section 01352 "LEED Requirements."

1.1 REFERENCES

ASTM INTERNATIONAL (ASTM)

ASTM E 814 (2002) Fire Tests of Through-Penetration Fire Stops

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10 (2002) Standards for Portable Fire Extinguishers

1.2 RELATED DOCUMENTS

Section 01352 "LEED Requirements."

1.3 SUMMARY

This Section includes the following:

1. Portable fire extinguishers.
2. Fire-protection cabinets.
3. Mounting brackets for fire extinguishers.

See Division 9 painting Sections for field painting fire-protection cabinets.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Product data for each type of product indicated:

Fire Extinguishers.

Include rating and classification.

Fire Protection Cabinets.

Include door hardware, cabinet type, trim style, panel style, and details of installation.

SD-04 Samples

For each exposed cabinet finish.

SD-10 Operation and Maintenance Data

Include maintenance data for cabinets and fire extinguishers.

SD-12 LEED Submittals per Section 01352

Include manufacturer's product data and/or statement indicating that the product contains no halons - an ozone depleting substance.

1.5 QUALITY ASSURANCE

1.5.1 NFPA Compliance

Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

1.5.2 Fire Extinguishers

Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1.5.3 Fire-Rated Fire-Protection Cabinets

Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed.

1.6 COORDINATION

Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

1.7 WARRANTY

1.7.1 Special Warranty

Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Failure of hydrostatic test according to NFPA 10.
- b. Faulty operation of valves or release levers.

2. Warranty Period shall be twelve years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PORTABLE FIRE EXTINGUISHERS

2.1.1 General

Product to contain no halons.

Provide fire extinguishers throughout the facilities and ensure compliance with NFPA 10, as coordinated with the ANG base fire department. Locate an extinguisher at each facility exit door. Fire extinguishers shall be placed both interior and exterior of the facility, as required. Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

2.1.2 Multipurpose Dry-Chemical Type in Steel Container

UL-rated 4-A:60-B:C, Amerex Model #441 or equivalent, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in red enameled-steel container.

2.2 FIRE PROTECTION CABINETS

Provide and ensure Compliance of fire extinguisher cabinets throughout the facilities and ensure compliance with NFPA 10, as coordinated with the ANG base fire department. All extinguisher cabinets shall be recessed unless wall thickness is not adequate for recessed cabinets, in which case semi-recessed may be used. All cabinets shall have eased corners, glass face and shall be red in color. Locked style cabinets are **not** approved for use.

Cabinets shall be of heavy duty brushed stainless steel construction. Cabinets shall be suitable to accommodate an Amerex, Model 441, 10lb ABC fire extinguisher.

2.2.1 Door Hardware

Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style.

2.2.2 Accessories

2.2.2.1 Mounting Bracket

Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, with plated or baked-enamel finish.

2.2.2.2 Lettered Door Handle

One-piece, cast-iron door handle with the word "FIRE" embossed into face.

2.2.2.3 Identification

Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.

- a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

- 1) Location: Applied as directed.
- 2) Application Process: Decals.
- 3) Lettering Color: To be selected.
- 4) Orientation: Vertical.

2.2.3 Finishes

Manufacturer's standard baked-enamel paint for the following:

- a. Exterior of cabinet, door, and trim, except for those surfaces indicated to receive another finish.
- b. Interior of cabinet and door.

2.3 FABRICATION

2.3.1 Fire Protection Cabinets

Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth.

1. Construct fire-rated cabinets with double walls fabricated from 0.0428-inch-thick, cold-rolled steel sheet lined with minimum 5/8-inch-thick, fire-barrier material. Provide factory-drilled mounting holes.

2.3.1.1 Cabinet Doors

Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Miter and weld perimeter door frames.

2.3.1.2 Cabinet Trim

Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

PART 3 EXECUTION

3.1 INSTALLATION

Install fire-protection specialties according to manufacturer's recommendations.

-- End of Section --

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SECTION 10800

TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A112.18.1M (1996) Plumbing Fixture Fittings

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M (2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 366/A 366M (1997e1) Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality

ASTM A 385 (2003) Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)

ASTM A 525 (1993) Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

ASTM A 526/A 526M (1990) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality

ASTM A 568/A 568M (2003) Standard Specifications for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for

ASTM B 456 (2003) Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium

ASTM C 1036 (2001) Standard Specification for Flat Glass

ASTM D 2092 (1995; R 2001e1) Standard Practice for Preparation of Zinc-Coated Galvanized Steel Surfaces for Paint

INTERNATIONAL CODE COUNCIL (ICC)

ICC A117.1 (1998) American National Standards for
Accessible and Usable Buildings and
Facilities

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330,
"Submittal Procedures," in sufficient detail to show full compliance with
the specification:

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following
items:

Mirror Glass
Mounting Devices and Fasteners
Paper Towel Dispensers
Waste Receptacle
Feminine Napkin Dispenser
Feminine Napkin Disposal
Toilet Tissue Dispenser
Liquid-Soap Dispenser
Shelf
Framed Mirrors
Medicine Cabinets
Grab Bars
Towel Bar
Shower-Curtain Rod
Robe Hook

SD-04 Samples

Samples shall be submitted in accordance with paragraph entitled,
"Accessories," of this section.

1.3 DELIVERY, HANDLING, AND STORAGE

Materials shall be protected from weather, soil, and damage during
delivery, storage, and construction.

Materials shall be delivered in their original packages, containers, or
bundles bearing the brand name and the name of the material.

PART 2 PRODUCTS

2.1 MATERIALS

Corrosion-resistant steel shall conform to AISI, Type 302. The exposed
surfaces shall have a No. 4 finish, unless otherwise specified.

Brass shall be forged, in accordance with ANSI A112.18.1M.

Steel sheet shall conform to ASTM A 366/A 366M and ASTM A 568/A 568M. Surface preparation and pretreatment shall be provided as required for the subsequent finish.

Galvanized-steel sheet shall be hot-dipped, minimum spangle, conforming to ASTM A 526/A 526M, with not less than a 1.25-ounce zinc coating in accordance with ASTM A 525. The surface preparation for painting shall conform to ASTM D 2092, Method A.

2.2 COATINGS

Chromium coating shall be nickel and chromium electrodeposited on brass, conforming to ASTM B 456, type and class as specified. Coating shall have a satin finish unless otherwise specified.

Enamel coating shall be factory applied, gloss white, baked acrylic. Coating shall be washable and suitable for the intended use.

2.3 MIRROR GLASS

Mirror glass shall be Type 1, Class 1, quality q1, 1/4-inch-thick float glass with silvering, copper backing, and protective coating, in accordance with ASTM C 1036.

2.4 MOUNTING DEVICES AND FASTENERS

Concealed mounting devices and fasteners for accessories shall be fabricated from the same materials as the accessories or from galvanized steel, conforming to ASTM A 385 and ASTM A 123/A 123M. Exposed mounting devices and fasteners shall be finished to match the accessories. Fasteners shall be the theft-resistant type.

2.5 ACCESSORIES

Samples of each toilet and bath accessories to be used shall be submitted prior to installation. Approved full-size samples may be installed in the work provided they are properly identified.

2.5.1 Paper Towel Dispensers (to be supplied by Owner)

2.5.2 Waste Receptacle

Recessed receptacles shall be not less than 0.031-inch thick corrosion-resistant steel with joints continuously welded. Flange shall be fabricated from one piece seamless construction with no mitered corners. Door shall be hung with a full-length corrosion-resistant steel piano hinge and secured with a tumbler lock. The removable waste container shall have a capacity of not less than 1.2 cubic feet.

Surface-mounted receptacles shall be rectangular in shape and fabricated from not less than 0.031-inch thick corrosion-resistant steel. Exposed surfaces shall be seamless construction with a continuously welded bottom pan. Receptacle shall have a capacity of not less than 2.7 cubic feet.

Heavy-duty vinyl removable liners shall be provided for refuse. Liner shall be secured to the receptacle at four points with grommets hung from corrosion-resistant steel hooks.

2.5.3 Toilet Tissue Dispenser (to be supplied by Owner)

2.5.4 Liquid-Soap Dispenser (to be supplied by Owner)

2.5.5 Shelf

Shelf shall be fabricated from not less than 0.050-inch thick corrosion-resistant steel, full length without seams, with not less than a 1/2-inch edge face and exposed edges rolled. Mounting brackets shall be fabricated from not less than 0.063-inch thick corrosion-resistant steel welded to the bottom of the shelf. Provide two brackets for the first 24 inches of shelf and one additional bracket for each additional 12 inches of length.

2.5.6 Mirrors

Framed Mirrors shall be fabricated to the size indicated. Mirror frame shall be fabricated from not less than 0.031-inch thick corrosion-resistant steel with corners mitered, welded, and ground smooth and a face width of not less than 5/8 inch. Backing sheet shall be fabricated from not less than 0.0396-inch thick galvanized steel secured to the frame with concealed screws. Edges and back of the mirror glass shall be protected with continuous wood fill strips and moisture-proof shock-absorbing back padding. Concealed galvanized-steel wall hanger of the size required for the mirror size shall be provided. Mirror shall be hung and locked in place with not less than two vandal-resistant locking screws per mirror.

Frameless mirrors shall be fabricated to the sizes indicated. Mirrors shall be fabricated of the specified mirror glass, and have smooth, polished edges. Mirrors shall be secured at the bottom in continuous full-width channel-type retaining strips mounted against the wall on top of the vanity back-splash. Mounting clips shall secure the mirror to the wall along the top and at both sides. Mounting clips and channels shall be manufacturer's standard.

2.5.7 Grab Bars

Bars shall be fabricated from not less than 0.049-inch thick, 1-1/4 inch outside diameter seamless corrosion-resistant steel tubing. Wall flanges shall be fabricated for a concealed installation from not less than 0.094-inch thick corrosion-resistant steel not less than 3 inches in diameter. Flanges shall be fully welded to the grab bar. A concealed mounting plate shall be fabricated from corrosion-resistant or galvanized steel. Secure flanges to the mounting plate with not less than four corrosion-resistant steel vandal-resistant setscrews. Exposed surfaces shall have a finish as specified unless the finish is indicated as nonslip. Nonslip finish shall have a peened or light knurled finish.

2.5.8 Towel Bar

Bar shall be fabricated from not less than 0.049-inch-thick, 3/4-inch outside diameter, seamless corrosion-resistant steel tubing. Support posts shall be fabricated for a concealed installation from satin-finish chromium-plated brass or corrosion-resistant steel. Concealed mounting brackets shall be fabricated from the same material as the support posts. Support posts shall be secured to the mounting brackets with a locking setscrew.

2.5.9 Shower-Curtain Rod

Rod shall be fabricated from not less than 0.035-inch-thick, 1-inch outside diameter, seamless corrosion-resistant steel tubing. Support flanges shall be fabricated from not less than 0.125-inch thick corrosion-resistant steel not less than 3 inches in diameter.

2.5.10 Robe Hook

Hook shall be the double type fabricated from satin-finish chromium-plated brass. The projection from the back of the flange to the end of the hook shall be not less than 2 inches. The concealed mounting bracket shall be fabricated from solid brass. Hook shall be secured to the mounting bracket with a locking setscrew.

PART 3 EXECUTION

3.1 GENERAL

Field measurements shall be taken prior to the preparation of drawings and fabrication to ensure proper fits.

Accessories shall be secured to the supporting substrates with anchors of the types indicated by the following substrate construction.

3.2 TILE CEMENTED ON PLASTER OR GYPSUM-BOARD WALL

Accessories shall be secured with toggle bolts using not less than No. 10-24 screws of the length required for the finish thickness.

3.3 GYPSUM BOARD

Accessories shall be secured with toggle bolts or expansion sleeve screws. Toggle bolts shall be not less than No. 10-24 screws of the length required for the finish thickness. Expansion-sleeve screws shall be not less than No. 6-32 screws or No. 10-24 screws of the lengths required for the finish thickness.

3.4 METAL PARTITIONS

Accessories shall be secured with T-nuts and through-bolts not less than No. 10-24 of the lengths required for the partition thickness.

3.5 GRAB-BAR ANCHORS

Through-bolt anchors shall be used for solid masonry or concrete walls

where the backplate is concealed or covered with a subsequent finish. An adhesive-applied anchor plate shall be used only when a through-bolt plate would be exposed. An embedded plate anchor shall be used for hollow partitions and solid gypsum partitions.

Through-bolt anchors shall be designed and installed to have a withdrawal strength of not less than 300 pounds per anchor. Front and back plates shall be fabricated from not less than 0.187-inch thick steel with the surface area required for the design strength. Through bolts shall be not less than 0.250-inch diameter threaded rod with a hexnut and lockwasher. The length of the rod shall be determined by the wall thickness.

Adhesive-applied anchor plate shall be fabricated from not less than 0.0396-inch thick perforated plate adhesive-applied to the supporting substrate. Adhesive shall be a thermoset epoxy-based resin which shall develop not less than 300 poundsshear strength per bar anchor. Grab-bar back plate shall be secured to the anchor plate with not less than two No. 10-24 screws of the length required for the thickness.

Embedded plate anchors shall be fabricated from not less than 0.125-inch thick plates with the width and length of the bar as indicated. Plate shall be U-clamped to the partition studs or channels. Embedded plates shall be secured to the studs or channels on each side of the grab-bar support. Bar back plate shall be secured to the anchor plate with not less than two No. 10-24 screws of the length required for the thickness.

3.6 HANDICAP ACCESSORIES

Toilet and bath accessories designated for handicap requirements shall be installed in accordance with ICC A117.1.

3.7 CLEANING

Surfaces of the work, and adjacent surfaces soiled as a result of the work, shall be cleaned as recommended by the manufacturer.

-- End of Section --

SECTION 11141

SEMI-DOWN DRAFT PAINT SPRAY BOOTH

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

This Section includes a semi-down draft spray paint booth and related equipment of the performance class indicated.

1.3 PERFORMANCE REQUIREMENTS

Paint Booth: Semi-down draft spray paint booth to conform to the following requirements:

- NFPA-33 Standard for Spray Application using Flammable or Combustible Materials.
- NFPA-91 Standard for Exhaust Systems for Conveying of Materials.
- NFPA-101 Life Safety Code.
- NFPA-70 National Electric Code.

Fresh Air System: Supplied air respirator protection which includes air breathing pumps and supply air hoses.

NIOSH Non CBRN environments.

1.4 SUBMITTALS

Product Data including the following:

- Construction details and fabrication methods.
- Profiles and dimensions of individual components.
- Data on hardware, accessories, and finishes.
- Certified fan-performance curves with system operating conditions indicated.
- Motor ratings, electrical characteristics, and motor and fan accessories.
- Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric data.
- Emergency lighting unit battery and charger.
- Fluorescent ballasts.
- Types of lamps.

Fresh Air System: Breathing air line; intake/exhaust filter, pressure relief valve, pressure gauge, air breathing pump.

Shop Drawings showing fabrication and installation including information not fully detailed in manufacturer's standard Product Data and the following:

Layout and installation details, including anchors.
Sections at 1/4-inch = 1 foot scale indicating the below slab ductwork requirements.

Maintenance Data: To include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

Installer Qualifications: Engage an experienced Installer who has completed installation of paint spray booths similar in material, design, and extent to those required for this Project and with a record of successful in-service performance.

Single-Source Responsibility: Obtain semi-down draft spray paint booth and related equipment from one source and by a single manufacturer. Includes direct-fired natural gas makeup air unit.

1.6 COORDINATION

Coordinate location and placement of makeup air unit, exhaust fan, and related ductwork with building structure. Fresh air system to location.

1.7 WARRANTY

General Warranty: The special warranty specified in this Article shall not deprive the Government of other rights the Government may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

Warranty Period: 1 year after date of Substantial Completion for all electric and non-electric parts.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following or an equal approved by Contracting Officer:

Semi-down draft Spray Paint Booth:

Ameri-cure, Inc. 1-800-572-2873 <http://www.ameri-cure.com>
Bleeker Brothers 1-800-421-1107 <http://www.bleekerbros.com>
Garmat USA 1-800-442-7628 <http://garmat.com>
Spray-tech 1-800-535-8196 <http://www.spraytech.com>
Grabber Manufacturing Co., Inc. 1-800-841-3220
<http://www.grabber.com>

Global Finishing Solutions 1-800-848-8738
<http://globalfinishing.com>

2.2 CABIN ASSEMBLY

27 feet long by 14 feet wide by 9 feet high (approximate inside dimensions), minimum 18 gauge prefinished galvanized steel panels.

2.3 DOORS

Entrance: Heavy-duty bi-fold doors with tempered glass observation windows. Doors to have rubber seals and a positive latching device.

Personnel: Minimum 30 inch by 80 inch outswinging door with tempered glass observation window.

2.4 BOOTH FILTRATION SYSTEM

Pre-Filtration: Provide washable pre-filters.

Ceiling Filters: Manufacturer's standard high efficiency filtered plenum.

Extract Filters: Provide manufacturer's standard extract filters.

2.5 LIGHTING ASSEMBLY

General: Comply with Division 16511 Interior lighting requirements for electrical fixtures, lamps, and ballasts.

Fixtures: Provide minimum of 12 UL approved, sealed, four bulb fluorescent fixtures with explosion proof frames, mounted behind tempered glass.

Lamps: Provide 48 inch, 32 watt, 3500 deg K, 86 CRI fluorescent lamps.

Ballasts: Comply with Section #6511.

2.6 MECHANICAL COMPONENTS

Motors: UL Approved, 3 phase, 200/60 hz, 5 hp exhaust motor.

Exhaust Fan: Industrial duty belt driven exhaust fan capable of over 12,000 CFM at 1/4-inch external static pressure.

Make-Up Air Unit: Natural gas, direct-fired makeup air unit shall be furnished with paint booth and meet the requirements of Section 15561 Direct-Fired Makeup Air Units. The unit shall be part of an integral system consisting of paint booth, exhaust fan and related operational controls. The required airflow supply and exhaust rates as well as the airflow resistance shall be determined by the paint booth manufacturer. Those shown in the equipment schedule are for the specified unit with 1/4-inch w.c. external resistance. Coordinate any change in fan horsepower from those listed with Electrical Contractor.

2.7 FIRE SUPPRESSION

Booth to be designed to accept fire suppression system supplied in Division 13935.

2.8 FABRICATION

General: Fabricate Semi-down draft paint spray booth to comply with indicated standards. Include a complete system for assembly of components and anchorage of booth.

2.9 FINISHES

Wall and Ceiling Finish: "Porcelain like" polyurethane and polyester powdercoated galvanized steel.

Color to be White.

2.10 SUPPLY AIR SYSTEM

Direct fired natural gas makeup air unit. 1.2 million BTU with fully modulating gas valve. 10 hp, 208, 30/60 hz, 12,000 CFM.

2.11 INSPECTION

Inspect floor and wall openings before installation. Verify that opening size is adequate to comply with ductwork requirements.

2.12 FRESH AIR SYSTEM

Air intake and exhaust filter, HEPA rated outlet filter to breathing supply line. Replaceable filter elements.

Pressure relief valve, pressure gage 0-30 psi with 2 inch dial. 100 feet PVC flexible lightweight breathing air hose 1-1/2 hp oil - less air pump. Supplies 2 or more respirators at 6 CFM per respirator. Low pressure pump of 0-10 psi, portable unit. Operates on electrical use of 30 amps or less and 115 volts.

Government will furnish respirator kit and face mask or hood.

Manufacturers:

SAS Safety Corporation - Pump Model 9840-00.
3M Company.
Rhine Air Inc. - Pump Model NF-1100A.

PART 3 EXECUTION

3.1 INSTALLATION

Comply with manufacturer's Specifications and recommendations for installing booth panels, hardware, lighting, mechanical components, and other components of the Work.

Coordinate installation of booth with fire suppression, mechanical and electrical systems that are not included as part of the semi-down draft spray paint booth package.

Provide necessary ductwork and supporting devices to install exhaust fan and makeup air unit. MAU-1 to be directly connected to paint booth plenum inlet. Refer to Drawings.

Coordinate installation of fresh air system pump, breathing hose, and associated equipment required for a complete system.

3.2 FIELD QUALITY CONTROL

Inspect each installed component for damage. Replace all damaged components.

Tests: As follows:

Verify normal operation of each component after installation.

Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

Remove malfunctioning units, replace with new units, and retest.

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.

Verify normal transfer to battery source and retransfer to normal.

Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

3.3 STARTUP SERVICE

Engage a factory-authorized service representative to perform startup service.

Final Checks before Startup: Perform the following:

Verify that shipping blocking, and bracing has been removed.

Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete.

Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.

Disconnect fan drive from motor, verify proper motor rotation direction, and verify free fan wheel rotation and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards. This includes supply and exhaust fans.

Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.

Install clean filters.

Verify that motorized two position outside air damper, installed on the inlet to the main are installed and fully operational prior to the starting of the makeup air fan. This outside air damper shall be

sequenced to open prior to the starting of the makeup air fan.

Refer to Division 15 Section "Testing, Adjusting, and Balancing" for modular indoor air-handling system testing, adjusting, and balancing.

3.4 DEMONSTRATION

Engage a factory-authorized service representative to train Government's maintenance personnel to adjust, operate, and maintain semi-down draft spray paint booth. Refer to Division 1 Section "General Requirements."

-- End of Section --

SECTION 11241

BLAST ROOM FACILITY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

This Section includes a Blast Room Facility and related equipment of the performance class indicated.

1.3 SUBMITTALS

Product Data including the following:

- Construction details and fabrication methods.
- Profiles and dimensions of individual components.
- Data on hardware, accessories, and finishes.
- Certified fan-performance curves with system operating conditions indicated.
- Motor ratings, electrical characteristics, and motor and fan accessories.
- Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric data.
- Emergency lighting unit battery and charger.
- Fluorescent ballasts.
- Types of lamps.

Shop Drawings showing fabrication and installation including information not fully detailed in manufacturer's standard Product Data and the following:

- Layout and installation details, including anchors.
- Sections at 1/4-inch = 1 foot scale indicating the below slab ductwork requirements.

Maintenance Data: To include in maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

Installer Qualifications: Engage an experienced Installer who has completed installation of Blast Room Facilities similar in material, design, and extent to those required for this Project and with a record of successful in-service performance.

Single-Source Responsibility: Obtain Blast Room Facility and related

equipment from one source and by a single manufacturer. Includes direct-fired natural gas makeup air unit.

1.5 COORDINATION

Coordinate location and placement of makeup air unit, exhaust fan and related ductwork with building structure.

1.6 WARRANTY

General Warranty: The special warranty specified in this Article shall not deprive the Government of other rights the Government may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

Warranty Period: 1 year after date of Substantial Completion for all electric and non-electric parts.

PART 2 PRODUCTS

2.1 BLAST ROOM ENCLOSURE

The entire room structure is supplied knocked-down and prime coated after metal preparation. All wall and ceiling panels are designed to be bolted together at installation. All panel to panel joints are sealed with sealant during assembly, to insure an air-tight joint. Prior to installation the foundation must be flat, level, and square. All access doors are equipped with safety interlocks to interrupt the blasting operation if a door is opened.

Interior Dimensions: 20 feet long by 10 feet wide by 10 feet high.

Ventilation Velocity: Average 50 feet per minute.

Walls: Wall panels are fabricated from 10 gauge steel construction in (nominal) 42 inch increments. Panels have a double formed flange for added structural integrity. Bolt spacing for the panels is every 6 inches using 3/8-inch fasteners for assembly.

Ceiling: Ceiling panels are fabricated from 10 gauge steel construction in (nominal) 42-inch increments. Panels have a double formed flange for added structural integrity. Bolt spacing for the panels is every 6 inches using 3/8-inch fasteners for assembly.

Doors: (One End) Doors are fabricated weldments utilizing a combination of structural tubing, and 16 ga. hot rolled steel sheet. The doorframe consists of two (2) structural steel columns with hinge weldments attached and a structural steel header. Doors pivot on 4 by 4 1/2-inch hinges equally spaced for maximum support. Filtered and baffled air inlets for room ventilation are located in lower portion of door panels. Resilient rubber strips are provided to prevent leakage when doors are in the closed position.

Personnel Door: One (1) door for personnel access is provided. Nominal door size is 3 feet x 6 feet-8 inches.

Lighting: Ceiling mounted fluorescent light fixtures are set in dust-tight enclosures and are serviceable from outside the room. Each module consists of four (4) 40 watt, 48 in. fluorescent lights mounted in a reflector housing. Lights are protected by 1/4 inch thick wire mold glass, which is flush with interior room ceiling. A total of eight (8) light modules are provided.

Air Flow: Exhauster suction, through the dust collector and ducting network, creates a negative pressure of 1/2 in. w.g. (nominal) at one end of the blast room. This causes free air to be drawn through air inlets at the opposite end of the room, developing a crossdraft airflow. Exhaust outlet is baffled to permit only carry-out of dust-laden air. Inlets and outlets are proportionately sized to ensure proper air volume required by state and local pollution codes.

2.2 PNEUMATIC RECOVERY SYSTEM

The recovery system consists of 'M' shaped recovery channels called M-Sections(r), which are connected to a collection duct, called a transition unit. Spent media is conveyed through this system by high velocity air flow. The entire M-Section(r) floor area is covered by steel grating.

Recovery Area: There are ten (10) each one (1) foot wide by twenty (20) feet long recovery ducts covering a total of two hundred (200) square feet.

Floor Recovery Ducts: The floor recovery ducts ('M' -Sections(r)) are of 16 ga. and 12 ga. hot-rolled steel construction. Media falls through the grating into the recovery channels, and is moved pneumatically to the transition duct.

Transition Unit: A pneumatic conveying transition duct runs perpendicular to, and at the end of the M-Section(r) recovery ducts. It is connected to each of the recovery ducts, and is designed to allow a predetermined number of recovery ducts to convey media at one time. Periodically, other portions of the ducts are opened (timer controlled), thus some portion of the conveying ducts in the floor are open at all times. The housing is fabricated from 12 ga. hot-rolled steel.

Grating: The entire media recovery area ("M"-Sections(r)) is covered with steel grating, designed for 2,000lb/ft² uniform load capacity. This grating is supplied in easily removable sections.

2.3 RECLAIM SEPARATION SYSTEM

The media reclaim separation system is an air centrifuge, highly balanced separator, which receives all media and debris conveyed from the blasted workpiece through a vacuum conveying duct.

Operation: The cyclone action of the reclaim centrifugally separates the blast media from the conveying air stream and collects oversized debris in the filter screen and deposits reusable media into the storage hopper section. The dust and broken media is pulled through the center vortex tube along with air to the dust collection system. The centrifugal force causes the oversized debris and reusable media to spin closely to the outside wall of the reclaim, away from the vortex tube and the dust and broken media remain closer to the vortex tube because of the light weight. The material and air inside the reclaim has decreased in velocity because of the larger area of the reclaim itself. In the vortex tube, the velocity is increased which allows for the dust and broken media that is closer to the vortex tube to be pulled into the tube and exhausted to the dust collection system.

Nominal Capacity: 1200 CFM.

Size: 27 inch inside diameter.

Construction: The media reclaim is fabricated from a minimum of 12 ga. hot rolled steel.

Reclaim Motor: The media reclaim is powered by a 5 horsepower heavy-duty exhaustor mounted on top of the reclaim.

Standard Features: A gasketed air-tight access door is provided on the side of the reclaim for easy removal of the filter screen basket and for refilling of the media charge. The filter basket is provided to trap oversize debris. A rubber lined wearplate is provided in the inlet of the reclaim for added abrasive protection.

Efficiency: Reclaim efficiency is determined by the amount of media of the original size remaining in the reclaim with a minimum of original size media in the dust collection system after a prolonged use. At any time during operation of the properly sized and adjusted reclaim, approximately 80% of original sized media by weight will be retained. At the same time, approximately 20% of the original sized media, by weight, can be in the dust collector system. The efficiency can be increased or decreased by how closely the reclaim system is adjusted and monitored for the type of media being used.

Adjustments: Minor adjustment in the reclaim system can be made by adjusting static pressure which adjusts the air flow through the system. Major adjustments are made by an externally adjustable pipe inside the vortex tube which is standard on all the pull through dust collection systems.

2.4 PRESSURE BLAST MACHINE

The pressure blast equipment is specifically designed for use with all medias, and incorporates all features necessary for efficient performance. This equipment is designed and built by Clemco Industries, who holds appropriate records, certificates, and approvals on the pressure vessel.

Pressure Vessel: The media is fed into the compressed air stream from

a six (6) foot 3 capacity pressure vessel. This pressure vessel is 24" in diameter, and cylindrical in shape. It conforms with all appropriate ASME regulations and carries a National Board approval certificate, with a rating of 150 psig. The vessel has a conical bottom with a slope of 110 degrees. The top of the vessel is concave to allow automatic feeding of the media through the remote controlled closure that is located in the center of the concave head. This closure utilizes a rubber-to-rubber seal (commonly known as a "pop-up-valve") when closed. A flat steel "umbrella" is mounted over this filling valve to allow valve closure against a full head of media. During fabrication, the pressure vessels are abrasive blasted to remove any mill scale. A 6-inch by 8-inch handhole is provided for maintenance access. The pressure vessel is supplied with legs for stationary mounting on the equipment floor. All air piping on the blast machine is 1-1/4-inch I.D.

Media Flow Valve: The media flow control valve provided is Clemco's "Quantum" valve. This valve is designed so that the manually adjustable metering function and the pneumatically operated valve actuation function are accomplished separately, allowing for quick and inexpensive replacement of wear items. The valve is mounted at 45 degrees to the compressed air piping and includes a "clean-out" access plate above the flow control area.

Valve Operation: When the valve is opened by the remote control handle, the plunger is completely withdrawn from the abrasive flow. When the remote control handle is released, a spring closes the valve actuator, instantly stopping the abrasive flow. The control of the media feed is through gravity only when the pressure in the vessel is equal to the pressure in the compressed air piping.

The metering section of the valve incorporates a hardened stainless steel metering plate for long life. The metering valve allows fine adjustment from no-flow to fully opened no matter what abrasive is used.

Abrasive Cut-Off Switch: A pneumatic cut-off switch is provided to allow the use of compressed air from the blast nozzle for dust blow down on blasted surfaces. This switch controls the opening and closing of the grit valve from the remote control handle. When abrasive blasting is completed, the operator simply flips the switch to the off position, halting the flow of abrasive. The air valve remains open so that only high velocity compressed air flows from the nozzle. Releasing the RLX handle shuts down the entire unit.

Blast Hose: The blast hose, which conveys the compressed air and media to the blast nozzle, has an inside diameter of 1-1/4 inches and an outside diameter of 17/8 inches. It weighs 35 pounds per each 50 foot length. This hose is gum rubber lined and wrapped with a dual layer of tough nylon. The hose is rated at a working pressure of 150 psig. The hose lining is 3/16-inch thick, carbon-black impregnated rubber for static dissipation. It is fitted with lightweight, nylon quick couplings that mount externally, and incorporate automatically

interlocking safety wires.

Blast Nozzle: One 3/8-inch 10 tungsten carbide, rubber jacketed nozzle will be provided with the blast machine. Nozzles are manufactured of the highest quality materials, and designed for long life. Connection of the nozzle to the blast hose is accomplished with an externally mounted nozzle holder made of nylon.

Operator Remote Controls: The remote controls are of the pneumatic type, which incorporate a normally closed inlet valve and normally open outlet valve. Air pressure opens the inlet valve and closes the outlet valve to begin the blasting process. If there is a loss of air pressure to the valves, springs return the valves to their normal position.

2.5 Operator Protective Equipment

The operator of the blast room is provided with protective clothing and an environmentally controlled respiratory helmet, that is suitable for working in a dusty atmosphere. This operator protective equipment is designed by Clemco Industries, who is the holder of record of CE approval certificates from The National Institute of Occupational Safety and Health.

Helmet: The operator's helmet is of high-density polyethylene, double-walled construction, in conformance with and the approval of NIOSH. The helmet is fitted with a cape that extends a full 36 inches below the helmet bottom, and it has a removable inner collar. The air inlet is at the center rear of the helmet. The view window is large and includes a fixed inner lens of impact resistant clear cellulose acetate that is .040-inch thick. Twenty five (25) PETG co-polyester outer lenses are included.

Breathing Air Filter: This in-line filter is of die-cast aluminum construction, and is capable of filtering moisture and particles from the supplied air stream. It incorporates a pressure regulator and a pressure relief valve, and it is designed for floor or wall mounting. The filter material is three stage and includes activated charcoal, activated alumina, and fiberloft polyester material. THE FILTER DOES NOT REMOVE CARBON MONOXIDE (CO)

Cool Air Tube: The cool air tube is rated at 20 CFM and is of the vortex type. The adjustment control for cool air to the helmet is located on the cool air tube unit, within easy reach of the operator. This unit carries NIOSH approvals as part of the full system and with the same approval numbers.

Clothing: The coverall-type suit that is provided has wear resistant leather on the front, and porous cotton for the remainder. The suit includes fastening straps at each cuff and leg bottom. One pair of leather gloves is included.

Noise Levels: Noise levels generated by the respirator are measured inside the helmet at maximum airflow's obtainable within pressure and hose length requirements, and do not exceed 80 dBA.

Quantity: One (1) set of operator protective equipment is provided.

2.6 DUST COLLECTION EQUIPMENT

The model CDF-8 collector is of Clemco Industries' own design and manufacture. It is a "downflow" design, cartridge type, reverse pulse style, and is able to withstand temperatures from -20 degrees C to 97 degrees C. It is designed and built for continuous duty operation, and is of heavy duty construction.

CFM: 6,200 in this application. Fan shall be capable of delivering this air flow with 3 inches water column external static pressure (actual at 3,500 feet and 70 degrees F). Manufacturer shall include this external static pressure with the units internal loss to determine final fan/motor requirements.

Size: Approx. 40 inches wide by 88 inches deep by 181 inches high.

Assembly: The collector is partially assembled at the factory and will be shipped in sections. Lifting points are provided for handling and set up. The major subassemblies include the filter section, the hopper/leg section, and the exhaustor.

Construction: Standard construction of the unit is 3/16-inch and 10 ga. hot rolled steel, formed and reinforced to maintain structural integrity to 20 inches w.g. All wiring, air piping, solenoid and diaphragm valves are mounted externally. Inlet and outlet sizes are 16" x 37", and they are flanged for ease of ducting connection.

Cartridges: Cartridge cleaning is "on line" by reverse pulse flow of air. The sixteen (16) cartridges are 13 3/4 inch dia. by 26 inches long and are constructed of cellulose/polyester filter media, with suspension. Pressure limit is 22 inch Hg. vacuum. Maximum airflow per cartridge is 500 CFM. The filter/media area is 252 ft² per cartridge. Cartridge permeability allows an approximate maximum of 2 CFM of air to pass through one square foot of filter material with an initial pressure differential of 0.53 inch w.g. Filter media- efficiency is 99.7% for. 5 micron size particles.

Differential - Pressure Gauge: A differential pressure gauge is supplied to monitor the pressure between the dirty and clean side of the filters. This gauge helps determine the proper setting for the timer "Off" time.

Adjustable Timer: An adjustable timer for controlling the "On" and "Off" time of the air pulse is enclosed in a NEMA-4 control panel. "On" time does not have to be adjusted. The "Off" time controls the length of time between each pulse cycle.

Filter Access Doors: Access doors are provided for ease of filter service and maintenance.

Dust Drums: One (1) 55 gallon drum is provided.

Exhauster: Nominal 10 Hp., top mounted, direct drive, with outlet damper and exhaust extension.

2.7 ELECTRICAL CONTROL PANEL

The control panel is a NEMA 12 enclosure, which houses all electrical control components. All control buttons, indicator lights, and meters are mounted in the enclosure door, and are labeled for their particular function.

Primary Voltage: 460 v, 3 ph, 60 hz.

Lighting Requirements: 110 v, 1 ph, 60 hz.

Control Voltage: A step down transformer provides a fused, 110 v control circuit.

Dust Collector Motor Starter: One starter is provided for the dust collector exhauster motor.

Media Recovery Motor Starter: One starter is provided for the abrasive reclaiming motor.

Elapsed Time Indicator: An hour meter is provided to indicate recovery system operation and for determining maintenance schedules.

General Provisions: The electrical panel is completely preassembled and wired. All wires are number marked at both ends. Two copies of the wiring schematic and the overload heater list are provided inside the panel door, with two more copies provided at system delivery.

PART 3 EXECUTION

3.1 INSTALLATION

Comply with manufacturer's Specifications and recommendations for installing booth panels, hardware, lighting, mechanical components, and other components of the Work.

Coordinate installation of booth with fire suppression, mechanical and electrical systems that are not included as part of the semi-down draft spray paint booth package.

Provide necessary ductwork and supporting devices to install exhaust fan and makeup air unit. MAU-1 to be directly connected to paint booth plenum inlet. Refer to Drawings.

3.2 FIELD QUALITY CONTROL

Inspect each installed component for damage. Replace all damaged components.

Tests: As follows:

Verify normal operation of each component after installation.
Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.
Verify normal transfer to battery source and retransfer to normal.

Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

3.3 STARTUP SERVICE

Engage a factory-authorized service representative to perform startup service.

Final Checks before Startup: Perform the following:

Verify that shipping blocking, and bracing has been removed.
Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete.
Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
Disconnect fan drive from motor, verify proper motor rotation direction, and verify free fan wheel rotation and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards. This includes supply and exhaust fans.
Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
Install clean filters.
Verify that motorized two position outside air damper, installed on the inlet to the main are installed and fully operational prior to the starting of the makeup air fan. This outside air damper shall be sequenced to open prior to the starting of the makeup air fan.

Refer to Division 15 Section "Testing, Adjusting, and Balancing" for modular indoor air-handling system testing, adjusting, and balancing.

3.4 DEMONSTRATION

Engage a factory-authorized service representative to train Government's maintenance personnel to adjust, operate, and maintain semi-down draft spray paint booth. Refer to Division 1 Section "General Requirements."

-- End of Section --

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SECTION 12485

ENTRANCE MATS

PART 1 GENERAL

1.1 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-04 Samples

Manufacturer's standard color charts shall be submitted for Entrance Mats showing the manufacturer's recommended color and finish selections.

One sample of entrance mats of sufficient size to show corners, intersections, and other details of construction shall be submitted. After approval, the sample may be installed if properly identified.

PART 2 PRODUCTS

2.1 TYPE OF MATS

For design purposes, a walk off mat was selected and is located on Sheet A5.1.

Entrance mats shall be the industrial type; tire-fabric mats shall have uniform-size links a minimum of 3/8-inch thick, and shall be made from 95% recycled selected truck and bus tires. The synthetic cord shall be reinforced with a layer of synthetic fiber screen and vulcanized to a thin rubber backup. Nylon surface to be tufted. Product is to be highly resistant to organic deterioration and damage to the elements. Size to be 12 inch by 12 inch tile.

PART 3 EXECUTION

3.1 DELIVERY OF MATERIALS

Mats shall be delivered, unwrapped, inspected, and placed at indicated doors by the Contractor.

Packing materials shall be removed and disposed of by the Contractor.

-- End of Section --

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SECTION 12495

HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS AA-V-00200

(Rev B) Venetian Blinds

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Installation drawings shall be submitted for Venetian Blinds in accordance with the paragraph entitled, "Installation," of this section.

SD-04 Samples

Manufacturer's standard color charts shall be submitted for Venetian Blinds showing the manufacturer's recommended color and finish selections.

Sample Venetian Blinds: Two full-size by 12-inches long of each color shall be provided.

SD-07 Certificates

Certificates shall be submitted for Venetian Blinds showing conformance with FS AA-V-00200.

PART 2 PRODUCTS

For design purposes, a horizontal louver blind manufacturer and color has been chosen and are located on Sheet A5.1.

2.1 GENERAL

Venetian Blinds materials, fabrication, assembly, workmanship, finish, inspection, testing, and other similar items shall be in conformance with FS AA-V-00200.

Hold-down or sway-stop brackets shall be provided.

PART 3 EXECUTION

3.1 FIELD MEASUREMENTS

Contractor shall take measurements and be responsible for approved fitting and hanging.

3.2 INSTALLATION

Venetian Blinds shall be installed in a rigid, substantial manner, straight, plumb, and level with blinds located as indicated.

Mounting brackets shall be secured to supporting surfaces with anchors of types indicated by the following substrate construction. Spacing of mounting brackets shall not exceed 72 inches on center.

Mounting brackets shall be secured with toggle bolts to plaster on metal-lath surfaces, plaster on gypsum-lath surfaces, and gypsum board surfaces. Toggle bolt size shall be at least No. 10-24, length as required for wall thickness. Toggle bolts shall have a load-carrying strength of not less than 350 pounds per anchor.

3.3 CLEANING AND FINAL ADJUSTMENT

After completion of the installation, final adjustments to operating hardware, cords, louvers, and other parts of the blind assembly shall be performed to ensure proper operation. Exposed surfaces shall be cleaned and ready for use. Damaged, spotted, or otherwise defective parts shall be removed and replaced with new materials or repainted/restored at no additional cost to the Government.

-- End of Section --

SECTION 13000

COMMISSIONING - GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 DESCRIPTION

Commissioning: Commissioning (Cx) is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. This is achieved by beginning in the design phase and documenting design intent and continuing through construction, acceptance and the warranty period with actual verification of performance. The Cx process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.

Cx during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:

- Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.

- Verify and document proper performance of equipment and systems.

- Verify that O&M documentation left on site is complete.

- Verify that the Owner's operating personnel are adequately trained.

Cx does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

Abbreviations: The following are common abbreviations used in the Specifications and in the Commissioning Plan. Definitions are found in Section 1.5.

- A/E: Architect and Design Engineers.

- CA: Commissioning Authority.

- CC: Controls Contractor.

- CM: Construction Manager.

- Cx: Commissioning.

- Cx Plan: Commissioning Plan Document.

- EC: Electrical Contractor.

- FPT: Functional Performance Test.

- GC: General Contractor.

- MC: Mechanical Contractor.

- PC: Prefunctional checklist.

- Subs: Subcontractors to General.

- TAB: Test and Balance Contractor.

1.2 COORDINATION

Cx Team: The members of the Cx team consist of the Commissioning Authority (CA), the representative Construction Manager (CM), the General Contractor (GC), the Architect and design engineers (particularly the mechanical engineer), the Mechanical Contractor (MC), the Electrical Contractor (EC), the TAB representative, the Controls Contractor (CC), any other installing subcontractors or suppliers of equipment.

Management. The CA is hired by the Owner directly. The CA directs and coordinates the Cx activities. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.

Scheduling: The CA will work with the CM and GC according to established protocols to schedule the Cx activities. The CA will provide sufficient notice to the CM and GC for scheduling commissioning activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

The CA will provide the initial schedule of primary commissioning events at the commissioning scoping meeting. The Commissioning Plan-Construction Phase provides a format for this schedule. As construction progresses, more detailed schedules are developed by the CA. The Commissioning Plan also provides a format for detailed schedules.

1.3 COMMISSIONING PROCESS

Commissioning Plan: The commissioning plan provides guidance in the execution of the commissioning process. Just after the initial commissioning scoping meeting the CA will update the plan which is then considered the "final" plan, though it will continue to evolve and expand as the Project progresses. The Specifications will take precedence over the Commissioning Plan.

Commissioning Process: The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.

Commissioning during construction begins with a scoping meeting conducted by the CA where the commissioning process is reviewed with the commissioning team members. Additional meetings will be required throughout construction, scheduled by the CA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems. Equipment documentation is submitted to the CA during normal submittals, including detailed start-up procedures. The CA works with the Subs in developing startup plans and startup documentation formats, including providing the Subs with prefunctional checklists to be completed, during the startup process. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with prefunctional checklists being completed before functional testing.

The Subs, under their own direction, execute and document the prefunctional checklists and perform startup and initial checkout. The CA documents that the checklists and startup were completed according to the approved plans.

This may include the CA witnessing start-up of selected equipment.

The CA develops specific equipment and system functional performance test procedures. The Subs review the procedures.

The procedures are executed by the Subs, under the direction of, and documented by the CA.

Items of non-compliance in material, installation or setup are corrected at the Sub's expense and the system retested.

The CA reviews the O&M documentation for completeness.

Commissioning is completed before Substantial Completion.

The CA reviews, pre-approves and coordinates the training provided by the Subs and verifies that it was completed.

Deferred testing is conducted, as specified or required.

Additional Commissioning: The following narrative provides a brief overview of the additional commissioning tasks performed by and independent third party outside of the design firm.

Review of the construction documents confirming whether the design will or will not meet the owner's goals for the building systems.

Review the construction documents for adequate commissioning requirements.

Review contractor submittals for commissioned systems and equipment.

Create a recommissioning management manual to include the LEED reference guide. The manual should also include sequences of operation for all equipment, descriptions of energy and water saving features, seasonal startup and shutdown procedures, a list of diagnostic tools, etc. The manual is intended to provide the owner with in-depth tools and strategies for keeping the building running in optimal condition.

1.4 RESPONSIBILITIES

The responsibilities of various parties in the commissioning process are provided in this section. The responsibilities of the Mechanical Contractor, TAB and Controls Contractor are in Division 15 and those of the Electrical Contractor in Division 16.

All Parties:

Attend commissioning scoping meeting and additional meetings, as necessary.

Mechanical and Electrical Designers/Engineers (of the A/E):

Construction and Acceptance Phase:

Perform normal submittal review, construction observation, As-Built Drawing preparation, etc., as contracted. One site observation should be completed just prior to system startup. Provide any design narrative and sequences documentation requested by the CA. The designers shall assist (along with the Contractors)

in clarifying the operation and control of commissioned equipment in areas where the Specifications, Control Drawings or equipment documentation is not sufficient for writing detailed testing procedures.

Attend commissioning scoping meetings and other selected commissioning team meetings.

Participate in the resolution of system deficiencies identified during commissioning, according to the Contract Documents.

Prepare and submit the final as-built design intent and operating parameters documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.

From the Contractor's red-line Drawings, edit and update one-line diagrams developed as part of the design narrative documentation and those provided by the vendor as Shop Drawings for the chilled and hot water, supply, return and exhaust air systems.

Provide a presentation at one of the training sessions for the Owner's personnel.

Warranty Period: Participate in the resolution of non-compliance, non-conformance and design deficiencies identified during commissioning during warranty-period commissioning.

Commissioning Authority (CA):

The CA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CA may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the General Contractor and the design team.

The primary role of the CA is to develop and coordinate the execution of a testing plan, observe and document performance, and confirm that systems are functioning in accordance with the design intent and in accordance with the Contract Documents. The Contractors will provide all tools or the use of tools to start, checkout and functionally test equipment and systems.

Construction and Acceptance Phase:

Coordinates and directs the Cx activities using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all parties, frequently updated timelines and schedules and technical expertise.

Coordinate the Cx work with the GC, ensure that commissioning activities are being scheduled into the master schedule.

Revise, as necessary, Commissioning Plan-Construction Phase.

Plan and conduct a commissioning scoping meeting and other commissioning meetings.

Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.

Before startup, gather and review the current control sequences and interlocks and work with Contractors and Design Engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.

Review and approve normal Contractor submittals applicable to

systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.

Write and distribute prefunctional tests and checklists.

Develop assist in the development of start-up and initial systems checkout plans with Subs.

Perform site visits to observe installations. Attend selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for changes relating to the Cx process. Assist in resolving any discrepancies.

Witness random parts of the HVAC piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in final report.

Witness random parts of any ductwork testing and cleaning procedures, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in final report.

Approve prefunctional tests and checklist completion by reviewing prefunctional checklist reports and by selected site observation and spot-checking.

Approve systems startup by reviewing start-up reports and by selected site observation.

Review TAB execution plan.

Oversee control system FPTs and approve it to be used for TAB, before TAB is executed.

Approve air and water systems balancing by spot testing, by reviewing completed reports and by selected site observation.

With necessary assistance and review from installing contractors, write the functional performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing.

Analyze any functional performance trend logs and monitoring data to verify performance.

Coordinate, witness and approve manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.

Maintain a master deficiency and resolution log and a separate testing record.

Witness performance testing of smoke control systems by others and all other owner contracted tests or tests by manufacturer's personnel over which the CA may not have direct control. Document these tests and include this documentation in the final Cx report.

Review equipment warranties to ensure that the Owner's responsibilities are clearly defined.

Oversee and approve the training of the Owner's O&M staff.

Compile and maintain a commissioning record and building systems book(s).

Review and approve the preparation of the O&M manuals.

Provide a final commissioning report.

Warranty Period:

Coordinate and supervise required seasonal or deferred testing and deficiency corrections.

Return to the site at 10 months into the 12-month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

Construction Manager (CM):

Construction and Acceptance Phase:

With the CA, facilitate the coordination of the Cx work. With the CA and GC, ensure that commissioning activities are being scheduled into the master schedule. Enforce Cx milestones by withholding contractor payments when required.

Review the final Cx Plan-Construction Phase.

Coordinate the scheduling and attend the Cx scoping meeting and other Cx team meetings, as necessary.

Coordinate the normal review of Contractor submittals and furnish a copy of construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CA.

Review the FPT procedures submitted by the CA, prior to testing. When necessary, observe and witness prefunctional checklists, startup and FPTs of selected equipment.

Review commissioning progress and deficiency reports.

Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.

Assist the GC and CA in coordinating the training of owner personnel.

General Contractor (GC):

Construction and Acceptance Phase:

Facilitate the coordination of the commissioning work by the CA, and with the CM and CA ensure that commissioning activities are being scheduled into the master schedule.

Include the cost of commissioning in the total contract price.

Furnish a copy of all Construction Documents, addenda, change orders and approved submittals and Shop Drawings related to commissioned equipment to the CA.

In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.

Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.

A representative shall attend a commissioning scoping meeting and

other necessary meetings scheduled by the CA to facilitate the Cx process.

Coordinate the training of owner personnel.

Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

Warranty Period:

Ensure that Subs execute seasonal or deferred functional performance testing, witnessed by the CA, according to the Specifications.

Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and As-Built Drawings for applicable issues identified in any seasonal testing.

Equipment Suppliers (through the GC and Subs):

Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.

Assist in equipment testing per agreements with Subs.

Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor.

Through the Contractors they supply products to, analyze specified products and verify that the designer has specified the newest most updated equipment reasonable for this Project's scope and budget.

Provide information requested by CA regarding equipment sequence of operation and testing procedures.

Review test procedures for equipment installed by factory representatives.

1.5 DEFINITIONS

Acceptance Phase: Phase of construction after startup and initial checkout when functional performance tests, O&M documentation review and training occurs.

Approval: Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.

Architect / Engineer (A/E): the prime consultant (Architect) and sub-consultants who comprise the design team, generally the HVAC mechanical designer/engineer and the electrical designer/engineer.

Basis of Design: The basis of design consists of the logic and assumptions behind the design decisions made to meet the design intent. The basis of design describes the systems, components, conditions and methods chosen to meet the intent. Some reiterating of the design intent may be included.

Commissioning Authority (CA): The CA directs and coordinates the day-to-day

commissioning activities.

Commissioning Plan: An overall plan, developed before or after bidding that provides the structure, schedule and coordination planning for the commissioning process.

Contract Documents: The documents binding the Owner and GC involved in the construction of this Project (Drawings, Specifications, change orders, amendments, contracts, Cx Plan, etc.).

Control System: The central building energy management control system.

Construction Manager (CM) - the Owner's representative in the day-to-day activities of construction. CM is selected by the Owner to manage the project including: approving pay requests, executing change orders and RFIs and coordinating and enforcing project quality. The GC reports to the CM.

Datalogging: Monitoring flows, currents, status, pressures, etc. of equipment using stand-alone dataloggers separate from the control system.

Deferred FPTs: FPTs that are performed after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow the testing during normal construction.

Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents.

Design Intent: A document that lists the ideas, concepts and criteria of the project that is critical to the owner. It is initially the outcome of the programming and conceptual design phases.

Engineer's Design Narrative: Sections of either the Design Intent or Basis of Design, written by the design engineer, that explain the operation of the equipment and systems in the project.

Factory Testing: Testing of equipment on-site or at the factory, by factory personnel with an Owner's representative present.

Functional Performance Test (FPT): Test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The commissioning authority develops the functional test

procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. FPTs are performed after prefunctional checklists and startup are complete.

General Contractor (GC): The Prime Contractor for this project, with whom the Owner has contracted.

Indirect Indicators: Indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed.

Manual Test: Using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").

Monitoring: The recording of parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of control systems.

Over-written Value: Writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50 deg F to 75 deg F to verify economizer operation). See also "Simulated Signal."

Prefunctional Checklist (PC): A list of items to inspect and elementary component tests to verify proper equipment installation, provided by the CA to the Sub. Prefunctional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels, labels affixed, gages in place, sensors calibrated, etc.). However, some prefunctional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system). The word prefunctional refers to before functional testing. PCs augment and are combined with the manufacturer's start-up checklist. Even without a Cx process, contractors typically perform some, if not many, of the prefunctional checklist items the CA will recommend. However, few contractors document this in writing. The CA only requires that the procedures be documented in writing, and does not witness much of the prefunctional checklisting, except for larger or more critical pieces of equipment.

Sampling: Functionally testing only a fraction of the total number of identical or near identical pieces of equipment.

Simulated Condition: Condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).

Simulated Signal: Disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.

Specifications: The construction Specifications of the Contract Documents.

Startup: The initial starting or activating of dynamic equipment, including executing prefunctional checklists.

Subs: The subcontractors to the GC who provide and install building components and systems.

Test Procedures: The step-by-step, process which must be executed to fulfill the test requirements. The test procedures are developed by the CA.

Test Requirements: Requirements specifying what modes and functions, etc. shall be tested. The test requirements are not the detailed test procedures.

Trending: Monitoring and recording using the building control system.

Vendor: Supplier of equipment.

Warranty Period: Warranty period for entire Project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

1.6 SYSTEMS TO BE COMMISSIONED

The following systems will be commissioned in this Project.

Equipment and System	Functional Test Requirements Specified In:
HVAC System	
Pumps	15997
Piping systems	15997
Ductwork	15997
Variable frequency drives	15997
Air handlers	15997
Make-up Air Unit	15997
Blower Units	15997
VAV Boxes	15997
Exhaust Fans	15997
Testing, Adjusting and Balancing work	15997
HVAC control system	15997

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division Contractor for the equipment being tested. For example, the Mechanical Contractor of Division 15 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system in

Division 15, except for equipment specific to and used by TAB in their commissioning responsibilities.

Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price and LEFT ON SITE at the project's completion.

All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5 deg F and a resolution of + or - 0.2 deg F. Pressure sensors shall have an accuracy of + or - 5.0 percent of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 EXECUTION

3.1 MEETINGS

Scoping Meeting: The CA will plan and conduct a Cx scoping meeting that will coincide with the pre-construction meeting with the entire Cx team in attendance. Meeting minutes will be distributed to all parties by the CA. Information gathered from this meeting will allow the CA to revise the Cx Plan to its final version, which will also be distributed to all parties.

Miscellaneous Meetings: Other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subs. The CA will plan these meetings and will minimize unnecessary time being spent by Subs.

3.2 REPORTING

The CA will regularly communicate with all members of the commissioning team, through the CM, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.

Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.

A final summary report by the CA will be provided to the CM, focusing on evaluating commissioning process issues. All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report. PCs, FPTs and monitoring reports will be part of the final report.

3.3 SUBMITTALS

The CA will be provided with copies of approved submittal information,

required to facilitate the Cx work, through the A/E. This will be integrated into the normal submittal process and protocol of the construction team as defined at the pre-construction meeting. At minimum, this information will include the manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, sequences of operation, O&M data, performance data, any performance test procedures, Control Drawings and details of owner contracted tests. In addition, the installation and checkout materials that are shipped inside the equipment and the field checkout sheet forms to be used by the factory or field technicians shall be submitted to the CA. All documentation requested by the CA will be included by the Subs in their O&M manual contributions which will be ready for preliminary distribution 30 days after the last piece of equipment has arrived on-site.

The CA will review submittals related to the commissioned equipment for adequacy for developing test procedures and for nominal compliance with the contract documents. This review is intended primarily for the development of FPTs and only secondarily to verify compliance with equipment Specifications. The CA will notify the A/E of items missing or incomplete and such short-comings shall be remedied by the contractor.

The CA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

These submittals to the CA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CA will review and approve them. See Division 1 for specific requirements for O&M manuals, including the requirements for preliminary manuals to be complete 30 days after the arrival of the last piece of equipment on site.

3.4 START-UP, PREFUNCTIONAL CHECKLISTS (PCs) AND INITIAL CHECKOUT

The following procedures apply to all equipment to be commissioned.

General: PCs are important to ensure that the equipment and systems are hooked up and operational. They ensure that FPTs (in-depth system checkout) will proceed without delays. Each piece of equipment receives full prefunctional checkout. No sampling strategies are used. The prefunctional testing for a given system must be successfully completed prior to FPTs of equipment or subsystems of the given system. Completion of FPTs is a requirement for completion of commissioning which is a requirement for the granting of Substantial Completion.

Start-up and Initial Checkout Plan: The CA shall assist the Cx team members responsible for startup of any equipment in developing detailed start-up plans for all equipment. The primary role of the CA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed. Parties responsible for PCs and startup are identified in the Cx scoping meeting and in the checklist forms. Parties responsible for executing FPTs are identified in the testing requirements in Section 17000.

The prefunctional checklists indicate required procedures to be executed as part of startup and initial checkout of the systems and the party responsible for their execution.

These checklists and tests are provided by the CA to the GC. The GC determines which trade is responsible for executing and documenting each of the line item tasks and notes that trade on the form. Each form may have more than one trade responsible for its execution. The subcontractor responsible for the purchase of the equipment develops the full start-up plan by combining (or adding to) the CA's checklists with the manufacturer's detailed start-up and checkout procedures from the O&M manual and the normally used field checkout sheets. The plan will include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.

The full start-up plan could consist of something as simple as:

The CA's prefunctional checklists.

The manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.

The manufacturer's normally used field checkout sheets.

The subcontractor submits the full startup plan to the CA for review and approval.

The CA reviews and approves the procedures and the format for documenting them, noting any procedures that need to be added.

Sensor and Actuator Calibration.

All field-installed temperature, pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described below. Alternate methods may be used, if approved by the Owner before-hand. All test instruments shall have had a certified calibration within the last 12 months. Sensors installed in the unit at the factory with calibration certification provided, do not need to be field calibrated.

All procedures used shall be fully documented on the prefunctional checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.

Sensor Calibration Methods:

All Sensors: Verify that all sensor locations are appropriate and away from causes of erratic operation. Verify that sensors with shielded cable are grounded only at one end. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.

Sensors Without Transmitters: Standard Application. Make a reading

with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS) is within the tolerances in the table below of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.

Sensors With Transmitters: Standard Application. Disconnect sensor. Connect a signal generator in place of sensor. Connect ammeter in series between transmitter and BAS control panel. Using manufacturer's resistance-temperature data, simulate minimum desired temperature. Adjust transmitter potentiometer zero until 4mA is read by the ammeter.

Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the BAS. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship reset, reset relationship and P/I reaction. Reconnect sensor. Make reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS) is within the tolerances in the table below of the instrument-measured value. If not, replace sensor and repeat. For pressure sensors, perform a similar process with a suitable signal generator.

Tolerances, Standard Applications

Sensor	Required Tolerance (+/-)	Sensor	Required Tolerance (+/-)
Hot water temp	1.5F		
Outside air, space air, duct air temps	0.5F		
Pressures, air, water and gas	3% of design		
Flow rates, air	10% of design		

Valve and Damper Stroke Setup and Check:

EMS Readout: For all valve and damper actuator positions checked, verify the actual position against the BAS readout.

Set pumps or fans to normal non-operating mode. Command valve or damper closed, visually verify that valve or damper is closed and adjust output zero signal as required. Command valve or damper open, verify position is full open and adjust output signal as required. Command valve or damper to a few intermediate positions. If actual valve or damper position doesn't reasonably correspond, replace actuator.

Execution of Prefunctional Checklists (PCs) and Startup:

Several weeks prior to startup, the Subs and vendors schedule startup and checkout with the GC, CM and CA. The performance of the PCs, startup and checkout are directed and executed by the Sub or vendor. When checking off PCs, signatures may be required of other Subs for verification of completion of their work.

The CA shall observe, at minimum, the procedures for each piece of primary equipment, unless there are multiple units, (in which case a sampling strategy may be used). In no case will the number of units

witnessed be less than 20% of the total number of identical or very similar units.

For lower-level components or equipment, (e.g., VAV boxes, sensors, controllers), the CA shall observe a sampling of the prefunctional and start-up procedures. The sampling procedures will be identified in the commissioning plan.

The Subs and vendors shall execute startup and provide the CA with a signed and dated copy of the completed start-up and prefunctional tests and checklists.

Only individuals that have direct knowledge and have witnessed that a PC task was performed shall initial or check that item off.

Deficiencies, Non-Conformance and Approval in Checklists and Startup:

The Subs shall clearly list any outstanding items of the initial start-up and prefunctional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CA within two days of test completion.

The CA shall work with the Subs and vendors to correct and retest deficiencies or uncompleted items. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CA as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original non-compliance report.

Items left incomplete, which later cause deficiencies or delays during functional testing may result in backcharges to the responsible party. Refer to Part 3.6 herein for details.

3.5 FUNCTIONAL PERFORMANCE TESTS (FPTs)

This sub-section applies to all commissioning functional testing for all divisions.

The general list of equipment to be commissioned is found in Section 17000, Part 1.6.

The parties responsible to execute each test are listed with each test in Sections 17000.

Objectives and Scope. The objective of FPTs is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, no flow, equipment failure, etc. shall also be tested.

Development of Test Procedures: Before test procedures are written, the CA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements in Sections 17000, the CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each Sub or vendor responsible to execute a test, shall provide limited assistance to the CA in developing the procedures review (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CA shall provide a copy of the test procedures to the Sub(s) who shall review the tests for feasibility, safety, equipment and warranty protection.

The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.

The FPT forms developed by the CA will include (but not be limited to) the following information:

- System and equipment or component name(s).
- Equipment location and ID number.
- Unique test ID number, and reference to unique prefunctional checklist and a start-up documentation ID numbers for the piece of equipment.
- Date.
- Project name.
- Participating parties.
- A copy of the specification section describing the test requirements.
- A copy of the specific sequence of operations or other specified parameters being verified.
- Formulas used in any calculations.
- Required pre-test field measurements.
- Instructions for setting up the test.
- Special cautions, alarm limits, etc.
- Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format.
- Acceptance criteria of proper performance with a Yes/No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
- A section for comments.
- Signatures and date block for the CA.

Test Methods:

Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities. The CA may substitute specified methods or require an additional method to be executed, other than what was specified. The CA will determine which method is most appropriate for tests that do not have a method specified.

Simulated Conditions. Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.

Overwritten Values. Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable.

Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.

Simulated Signals. Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.

Altering Setpoints. Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55 deg F, when the outside air temperature is above 55 deg F, temporarily change the lockout setpoint to be 2F above the current outside air temperature.

Indirect Indicators. Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the test parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during prefunctional testing.

Setup. Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Sub executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.

Sampling. Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in prefunctional checklist execution.

A common sampling strategy referenced as the "xx% Sampling-yy% Failure Rule" is defined by the following example.

xx = the percent of the group of identical equipment to be included in each sample.

yy = the percent of the sample that if failing, will require another sample to be tested.

The example below describes a 20% Sampling-10% Failure Rule.

Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the "first sample."

If 10% (yy) of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample).

If 10% of the units in the second sample fail, test all remaining units in the whole group.

If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

Coordination and Scheduling: The Subs shall provide sufficient notice to the CA regarding their completion schedule for the prefunctional checklists and startup of all equipment and systems. The CA will schedule FPTs through the GC and affected Subs. The CA shall direct, witness and document the functional testing of all equipment and systems. The Subs shall execute the tests.

In general, functional testing is conducted after prefunctional testing and startup has been satisfactorily completed. The control system is sufficiently tested and approved by the CA before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

Test Equipment. Refer to Section 17000, Part 2 for test equipment requirements.

Problem Solving: The CA will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the GC, Subs and A/E.

3.6 DOCUMENTATION AND NON-CONFORMANCE OF TESTS

Documentation: The CA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose.

Non-Conformance:

The CA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted.

Corrections of minor deficiencies identified may be made during the

tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form.

Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues.

As tests progress and a deficiency is identified, the CA discusses the issue with the executing contractor.

When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:

- 1) The CA documents the deficiency and the Sub's response and intentions and they go on to another test or sequence. The CA submits the non-compliance reports to the CM. A copy is provided to the Sub. The Sub corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be retested and sends it back to the CA.
- 2) The CA reschedules the test and the test is repeated.

If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:

- 1) The deficiency shall be documented on the non-compliance form with the Sub's response and a copy given to the A/E and to the Sub representative assumed to be responsible.
- 2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Construction Manager.
- 3) The CA documents the resolution process.
- 4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CA. The CA reschedules the test and the test is repeated until satisfactory performance is achieved.

Cost of Retesting:

The cost for the Sub to retest a prefunctional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the GC.

For a deficiency identified, not related to any prefunctional checklist or start-up fault, the following shall apply: The CA will direct the retesting of the equipment once at no "charge" for their time. However, the CA's time for a second retest will be charged to the Owner, who will recover the costs from the GC, who may, in turn, recover the costs from the responsible Sub.

The time for the CA to direct any retesting required because a specific prefunctional checklist or start-up test item, reported to have been successfully completed, but determined during

functional testing to be faulty, will be charged to the Owner, who will recover the costs from the GC, who may, in turn, recover the costs from the responsible Sub.

The Contractor shall respond in writing to the CA at least as often as Cx meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.

The CA retains the original non-conformance forms until the end of the Project.

Any required retesting by any Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the prime Contractor.

Failure Due to Manufacturer Defect. If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the CM. In such case, the Contractor shall provide the Owner with the following:

Within one week of notification from the CM, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the CM within two weeks of the original notice.

Within two weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.

The CM will determine whether a replacement of all identical units or a repair is acceptable.

Two examples of the proposed solution will be installed by the Contractor and the CM will be allowed to test the installations for up to one week, upon which the CM will decide whether to accept the solution.

Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

Approval. The CA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CA and by the CM, if necessary.

3.7 OPERATION AND MAINTENANCE MANUALS

O&M Manuals:

CA Review and Approval: Prior to training (well before Substantial

Completion), the CA shall review the O&M manuals, documentation and as-built systems that were commissioned to verify compliance with the Specifications. The CA will communicate deficiencies in the manuals to the CM. The CA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This Work does not supersede the A/E's review of the O&M manuals according to the A/E's contract. Successful completion of the O&M manuals is a prerequisite for training and for the granting of Substantial Completion.

Cx Records:

Final Report Details: The final Cx report will include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the commissioning authority regarding the adequacy of the equipment, documentation and training meeting the Contract Documents in the following areas: 1) Equipment meeting the equipment Specifications, 2) Equipment installation, 3) Functional performance and efficiency, and 4) Operator training. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall also be listed. Each non-compliance issue shall be referenced to the specific functional test, inspection, trend log, etc. where the deficiency is documented. The functional performance and efficiency section for each piece of equipment shall include a brief description of the verification method used (manual testing, BAS trend logs, data loggers, etc.) and include observations and conclusions from the testing.

Other documentation will be retained by the CA.

3.8 TRAINING OF OWNER PERSONNEL

The GC shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed. Completion of training is a requirement for the granting of Substantial Completion. Note that completed and approved O&M manuals are the manuals used for training and that training can't begin until those manuals are completed.

The CA shall be responsible for overseeing and approving the content and adequacy of the training of the Owner personnel for commissioned equipment.

The Owner and CA shall decide how rigorous the training should be for each piece of commissioned equipment. The CA shall communicate the results to the Subs and Vendors who have training responsibilities. The specific training requirements of Owner personnel by Subs and vendors is specified in Division 15 and 16.

Each Sub and vendor responsible for training will submit a written training plan to the CA for review and approval prior to training. The plan will cover the following elements:

Equipment (included in training).

Intended audience.
Location of training.
Objectives.
Subjects covered (description, duration of discussion, special methods, etc.).
Duration of each subject.
Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)

For the primary HVAC equipment, the Control Contractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.

The CA develops an overall training plan and coordinates and schedules, with the GC, the overall training for the commissioned systems. The CA develops criteria for determining that the training was satisfactorily completed, including attending some of the training, etc.

Video-taping of the training sessions will be provided by the CA.

The mechanical design engineer shall at the first training session present the overall system design concept and the design concept of each equipment section. This presentation shall include a review of all systems using the simplified system schematics (one-line Drawings) including chilled water systems, heating systems, supply air systems, exhaust system and outside air strategies.

3.9 DEFERRED TESTING

Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the CM. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

Seasonal Testing: During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) shall be completed as part of this contract. The CA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate Subs, with the CA witnessing. Any final adjustments to the O&M manuals and as-builds due to the testing will be made by the necessary Subs.

3.10 WRITTEN WORK PRODUCTS

The commissioning process generates a number of written work products described in various parts of the Specifications. The Commissioning Plan-Construction Phase, lists all the formal written work products, describes briefly their contents, who is responsible to create them, their due dates, who receives and approves them and the location of the Specification to create them. In summary, the written products are:

	Product	Developed By
1.	Final commissioning plan	CA
2.	Meeting minutes	CA
3.	Commissioning schedules	CA with GC

4.	Overall Construction schedule	GC
5.	Equipment documentation submittals	Subs
6.	Sequence clarifications	Subs and A/E as needed
7.	Prefunctional checklists	CA (completed by subs, approved by CA)
8.	Startup and initial checkout plan (compilation of existing documents)	Subs (With CA assistance)
9.	Startup and initial checkout forms filled out	Subs
10.	Final TAB report	TAB
11.	Commissioning Progress Record	CA
12.	Deficiency reports	CA
13.	Functional test forms	CA
14.	Filled out functional tests	CA
15.	O&M manuals	Subs (approved by A/E and CA)
16.	Commissioning record book	CA
17.	Overall training plan	GC and Subs
18.	Specific training agendas	Subs
19.	Final commissioning report	CA
20.	Recommissioning Management Manual	Independent 3rd Party

-- End of Section --

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SECTION 13080

SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT

PART 1 GENERAL

1.1 SYSTEM DESCRIPTION

General:

The requirements for seismic protection measures described in this Section shall be applied to mechanical/electrical equipment and systems specified herein. Seismic protection requirements shall be in accordance with 2003 IBC 1621 using an importance factor of 1.0 and shall be provided in addition to any other requirements called for in other sections of these specifications. This facility shall be designed as being in seismic zone 2B; no other zone values shall be used to establish bracing requirements. Lateral support against earthquake induced forces shall be accomplished by positive attachments without consideration of friction resulting from gravity loads.

Mechanical/Electrical Equipment:

Mechanical/electrical equipment shall include the following items to the extent required on the Drawings or in other sections of these Specifications:

- Boilers
- Water Heaters
- Expansion Air Separator Tanks
- Heat Exchangers
- Water Chiller Units
- Control Panels
- Pumps with Motors
- Light Fixtures
- Motor Control Centers
- Storage Racks
- Suspended Ceiling Assemblies
- Unit Heaters
- Accumulator Tank
- Storage Tanks and Water
- Water and Gas Piping
- Cable Trays
- Air and Refrigerant Compressors
- Air Handling Units
- Transformers
- Ducts
- Exhaust and Return Fans

Mechanical/Electrical Systems: The following mechanical and electrical systems shall be installed as required on the Drawings and other sections of these Specifications and shall be seismically protected in accordance

with this Specification:

All Piping Inside the Building in Accordance With This Specification
Chilled Water Distribution Systems Outside of Buildings
Gas Distribution Systems
All Water Supply Systems
Storm and Sanitary Sewer Systems
All Process Piping

Exclusion: Seismic protection of piping for fire protection systems shall be installed as specified in Section 13916 Fire Protection.

Pipes and Ducts Requiring No Special Seismic Restraints:

Seismic restraints may be omitted from the following installations:

Gas piping less than 1 inch inside diameter.
Piping in boiler and mechanical equipment rooms less than 1-1/4 inches inside diameter.
All other piping less than 1-1/2 inches inside diameter.
Electrical conduit less than 2-1/2 inches inside diameter.
Rectangular air handling ducts less than 4 square feet in cross sectional area.
Round air handling ducts less than 18 inches in diameter.
Piping suspended by individual hangers 12 inches or less in length from the top of pipe to the bottom of the supporting structural member where the hanger is attached, except as noted below.
Ducts suspended by hangers 12 inches or less in length from the top of the duct to the bottom of the supporting structural member, except as noted below.

In exemptions g. and h. all hangers shall meet the length requirements.

If the length requirement is exceeded by one hanger in the run, the entire run shall be braced.

All Other Interior Piping, Conduit, and Ducts: Interior piping, conduit, and ducts not covered by paragraphs Exclusion or Pipes and Ducts Requiring No Special Seismic Restraints shall be seismically protected in accordance with the provisions herein.

1.2 SUBMITTALS

Hi-lite all descriptive literature to accomplish identification of specific components/items which are proposed to be furnished. Government will not react to descriptive material/literature which has not been hi-lited, except to reject the Submittal.

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01000 GENERAL REQUIREMENTS:

SD-01 Data

Bracing and Coupling; GA. Lighting Fixtures in Buildings; GA.

Miscellaneous Equipment; GA.

Copies of the design calculations with the detail Drawings. Calculations shall be stamped by a registered engineer and shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

SD-04 Drawings

Bracing and Coupling; GA. Flexible Couplings or Joints; GA. Resilient Vibration Isolation Devices; GA. Lighting Fixtures in Buildings; GA. Miscellaneous Equipment; GA.

Detail Drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.

SD-07 Certificates

Flexible Ball Joints; FIO.

Flexible ball joints shall be certified to be suitable for the service intended by the manufacturer, based on not less than 2 years' satisfactory operation in a similar application.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall conform to the requirements specified below or an equal approved by Contracting Officer:

Bolts and Nuts: Squarehead and hexhead bolts, and heavy hexagon nuts, ASME B18.2.1, ASME B18.2.2, or ASTM A 307 for bolts and ASTM A 563 for nuts. Bolts and nuts used underground and/or exposed to weather shall be galvanized in accordance with ASTM A 153.

Sway Bracing: Material used for members listed in this Section and on the Drawings, shall be structural steel conforming with the following or an equal approved by Contracting Officer:

Plates, rods, and rolled shapes, ASTM A 36.

Wire rope, ASTM A 603.

Tubes, ASTM A 500, Grade B.

Pipes, ASTM A 53, Type E or S, Grade B.

Light gauge angles, less than 1/4 inch thickness, ASTM A 653.

Flexible Couplings: Flexible couplings shall have same pressure and temperature ratings as adjoining pipe specified in Section 15569 WATER HEATING; GAS; UP TO 20 MBTUH, 15895 AIR SUPPLY, VENTILATION, AND EXHAUST SYSTEM, AND 15488 GAS PIPING SYSTEM.

Flexible Ball Joints: Flexible ball joints shall have cast or wrought steel casing and ball parts capable of 360-degree rotation plus not less than 15-degree angular movement.

Flexible Mechanical Joints:

Mechanical couplings for steel or cast iron pipe shall be of the sleeve type and shall provide a tight flexible joint under all reasonable conditions, such as pipe movement caused by expansion, contractions, slight settling or shifting of the ground, minor variations in trench gradients, and traffic vibrations. Where permitted in other sections of these specifications, joints utilizing split-half couplings with grooved or shouldered pipe ends may be used.

Sleeve-type couplings shall be used for joining plain-end pipe sections. The coupling shall consist of one steel middle ring, two steel followers, two gaskets, and necessary steel bolts and nuts to compress the gaskets. Underground bolts shall be high-strength type as specified above.

Lighting Fixture Supports: Fixture supports shall be malleable iron. Lighting fixtures and supports shall conform to UL 1570 or UL 1571 as applicable or an equal approved by Contracting Officer.

PART 3 EXECUTION**3.1 BRACING AND COUPLING**

Bracing and coupling shall conform to the arrangements shown. Provisions of this paragraph apply to all piping within a 1.5 m (5-foot) line around outside of building unless buried in the ground. Piping grouped for support on trapeze-type hangers shall be braced at the same internals as determined by the smallest diameter pipe of the group. No trapeze-type hanger shall be secured with less than two 1/2 inch bolts. Bracing rigidly attached to pipe flanges, or similar, shall not be used where it would interfere with thermal expansion of piping.

3.2 BUILDING DRIFT

Sway braces for a run shall not be attached to two dissimilar structural elements of a building that may respond differentially during an earthquake unless a flexible joint is provided. Joints capable of accommodating seismic displacements shall be provided where pipes pass through a building seismic or expansion joint, or where rigidly supported pipes connect to equipment with vibration isolators. For threaded piping, swing joints shall be provided. For piping with manufactured ball joints the seismic drift shall be 0.015 meters per meter (feet per foot) of height above the base where the seismic separation occurs; this drift value shall be used in place of the expansion given in the manufacturer's selection table.

3.3 FLEXIBLE COUPLINGS OR JOINTS

Building Piping: Flexible couplings or joints in building piping shall be provided at bottom of all pipe risers larger than 3-1/2 inches in diameter.

Flexible couplings or joints shall be braced laterally without interfering with the action of the flexible coupling or joint. Cast iron waste and vent piping need only comply with these provisions when caulked joints are used. Flexible bell and spigot joints using rubber gaskets or no-hub fittings may be used at each branch adjacent to tees and elbows for

underground waste piping inside of building to comply with these requirements.

Underground Piping: Underground piping and 4-inch or larger conduit, except heat distribution system, shall have flexible couplings installed where the piping enters the building. The couplings shall accommodate 75 mm of relative movement between the pipe and the building in any direction.

Additional flexible couplings shall be provided where shown on the Drawings.

3.4 PIPE SLEEVES

Pipe sleeves in interior non-fire rated walls shall be sized as indicated on the Drawings to provide clearances that will permit differential movement of piping without the piping striking the pipe sleeve.

3.5 SPREADERS

Spreaders shall be provided between adjacent piping runs to prevent contact during seismic activity whenever pipe or insulated pipe surfaces are less than 100 mm apart. Spreaders shall be applied at same interval as sway braces at an equal distance between the sway braces. If rack type hangers are used where the pipes are restrained from contact by mounting to the rack, spreaders are not required for pipes mounted in the rack. Spreaders shall be applied to surface of bare pipe and over insulation on insulated pipes utilizing high-density inserts and pipe protection shields in accordance with the requirements of Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.6 ANCHOR BOLTS

Cast-In-Place: Floor or pad mounted equipment shall use cast-in-place anchor bolts, except as specified below. Two nuts shall be provided on each bolt. Anchor bolts shall conform to the following tabulation for the various equipment weights and specified seismic zone or the manufacturer's installation recommendations, whichever is the most stringent, unless otherwise shown on the Drawings. Anchor bolts that exceed the normal depth of equipment foundation piers or pads shall either extend into concrete floor or the foundation shall be increased in depth to accommodate bolt lengths.

Minimum Bolt Sizes, Cast-In-Place Anchor Bolts

Max. Equip. Weight			Minimum Bolt Sizes (mm) *		
Kg	Zone 4	Zone 3	Zone 2A	Zone 2B	Zone 1
225	13	13	13	13	13
450	13	13	13	13	13
2250	13	13	13	13	13
4500	13	13	13	13	13
9000	13	13	13	13	13
13500	16	13	13	13	13
22500	22	16	13	13	13
45000	**	**	16	22	13

Max. Equip. Weight	Minimum Bolt Sizes (Inches) *				
Weight (lbs)	Zone 4	Zone 3	Zone 2A	Zone 2B	Zone 1
500	1/2	1/2	1/2	1/2	1/2
1,000	1/2	1/2	1/2	1/2	1/2
5,000	1/2	1/2	1/2	1/2	1/2
10,000	1/2	1/2	1/2	1/2	1/2
20,000	1/2	1/2	1/2	1/2	1/2
30,000	5/8	1/2	1/2	1/2	1/2
50,000	7/8	5/8	1/2	1/2	1/2
100,000	**	**	5/8	7/8	1/2

* Based on four bolts per item, a minimum embedment of 12 bolt diameters, a minimum bolt spacing of 16 bolt diameters and a minimum edge distance of 12 bolt diameters. Equivalent total cross-sectional area shall be used when more than four bolts per item are provided. Anchor bolts shall conform to ASTM A 307. Anchor bolts shall have an embedded straight length equal to at least 12 times nominal diameter of the bolt.

** Equipment weighting more than 50,000 lb. in Zones 3 and 4 shall have at least six bolts per item.

Expansion or Chemically Bonded Anchors

Expansion or chemically bonded anchors shall not be used unless test data in accordance with ASTM E 488 has been provided to verify the adequacy of the specific anchor and application. The expansion anchor size shall be not less than that required in paragraph Minimum Bolt Sizes, Cast-In-Place Anchor Bolts. Expansion and chemically bonded anchors shall be installed in accordance with the manufacturer's recommendations. The allowable forces shall be adjusted for the spacing between anchor bolts and the distance between the anchor bolt and the nearest edge, as specified by the manufacturer.

General Testing: Expansion and chemically bonded anchors shall be tested in place after installation. The tests shall occur not more than 24 hours after installation of the anchor and shall be conducted by an independent testing agency; testing shall be performed on random anchor bolts as described below.

Torque Wrenching Testing: Torque wrench testing shall be done on not less than 50 percent of the total installed expansion anchors and at least one anchor for every piece of equipment containing more than two anchors. The test torque shall equal the minimum required installation torque as required by the bolt manufacturer.

Torque wrenches shall be calibrated at the beginning of each day the torque tests are performed. Torque wrenches shall be recalibrated for each bolt diameter whenever tests are run on bolts of various diameters. The applied torque shall be between 20 and 100 percent of wrench capacity. The test torque shall be reached within one half turn of the nut, except for 3/8 inch sleeve anchors which shall reach their torque by one quarter turn of the nut. If any anchor fails the test, similar anchors not previously tested shall be tested until 20 consecutive anchors pass. Failed anchors shall be retightened and retested to the specified torque; if the anchor still fails the test it shall be replaced.

Pullout Testing: Expansion and chemically bonded anchors shall be tested by applying a pullout load using a hydraulic ram attached to the anchor bolt. At least 5 percent of the anchors, but not less than three per day shall be tested. The load shall be applied to the anchor without removing the nut; when that is not possible, the nut shall be removed and a threaded coupler shall be installed of the same tightness as the original nut. The test setup shall be checked to verify that the anchor is not restrained from withdrawing by the baseplate, the test fixture, or any other fixtures. The support for the testing apparatus shall be at least 1.5 times the embedment length away from the bolt being tested. Each tested anchor shall be loaded to 1 times the design tension value for the anchor. The anchor shall have no observable movement at the test load. If any anchor fails the test, similar anchors not previously tested shall be tested until 20 consecutive anchors pass. Failed anchors shall be retightened and retested to the specified load; if the anchor still fails the test it shall be replaced.

3.7 RESILIENT VIBRATION ISOLATION DEVICES

Selection of anchor bolts for vibration isolation devices and/or snubbers for equipment base and foundations shall follow the same procedure as in paragraph ANCHOR BOLTS except that an equipment weight equal to five times the actual equipment weight shall be used.

Resilient and Spring-Type Vibration Devices: Vibration isolation devices shall be selected so that the maximum movement of equipment from the static deflection point shall be 0.5 inch.

Multidirectional Seismic Snubbers: Multidirectional seismic snubbers employing elastomeric pads shall be installed on all floor- or slab-mounted equipment. These snubbers shall provide 0.25 inches free vertical and horizontal movement from the static deflection point. Snubber medium shall consist of multiple pads of cotton duct and neoprene or other suitable materials arranged around a flanged steel trunnion so both horizontal and vertical forces are resisted by the snubber medium.

3.8 SWAY BRACES FOR PIPING

Sway braces shall be provided to prevent movement of the pipes under seismic loading. Braces shall be provided in both the longitudinal and transverse directions, relative to the axis of the pipe. The bracing shall not interfere with thermal expansion requirements for the pipes as described in other sections of these Specifications.

Transverse Sway Bracing: Transverse sway bracing for steel and copper pipe shall be provided at intervals not to exceed those given in the tabulation below as modified for each seismic zone. All runs shall have a minimum of two transverse braces. Transverse sway bracing for pipes of materials other than steel and copper shall be provided at intervals not to exceed the hanger spacing as specified in section 15400 PLUMBING, GENERAL PURPOSE.

Maximum Span for Transverse Sway Braces in Seismic Zone 4:

Pipe Diameter (mm)	Std. Wgt. Steel Pipe - 40S		Ex. Strong Steel Pipe - 80S		Copper TubeType L	
	*L (m)	** F (kN)	*L (m)	** F (kN)	*L (m)	** F (kN)
25	6.7	0.30	6.7	0.4	3.4	0.08
40	7.6	0.60	7.9	0.8	3.7	0.16
50	8.8	1.0	9.1	1.3	4.3	0.30
65	9.8	1.7	10.0	2.1	4.8	0.50
80	10.4	2.5	10.7	3.2	5.2	0.70
90	11.0	3.3	11.6	4.1	5.5	1.0
100	11.9	4.3	12.2	5.3	5.8	1.3
125	12.5	6.4	13.4	8.5	6.1	2.1
150	13.7	9.4	14.0	12.2	6.7	3.3
200	14.9	16.6	16.5	22.9	7.9	6.9
250	16.5	27.1	18.0	34.1	8.5	11.7
300	17.7	38.1	18.6	46.0	9.4	17.6

Pipe Diameter (in.)	Std. Wgt. Steel Pipe - 40S		Ex. Strong Steel Pipe 80S		Copper Tube Type L	
(lbs.)	*L (ft.)	**F (lbs.)	*L (ft.)	**F (lbs.)	*L (ft.)	**F
1	22	70	22	80	11	17
1-1/2	25	140	26	180	12	35
2	29	220	30	290	14	70
2-1/2	32	380	33	460	15	110
3	34	550	35	710	17	150
3-1/2	36	730	38	930	18	220
4	39	960	40	1,200	19	300
5	41	1,440	44	1,900	20	470
6	45	2,120	46	2,750	22	730
8	49	3,740	54	5,150	26	1,550
10	54	6,080	59	7,670	28	2,630
12	58	8,560	61	10,350	31	3,950

* L = Maximum span between lateral supports multiplied by 1.1 for Zone 3, 1.25 for Zone 2A, 1.2 for Zone 2B, or 1.35 for Zone 1.

** F = Horizontal force on the brace multiplied by 0.8 for Zone 3, 0.5 for Zone 2A, 0.6 for Zone 2B, or 0.3 for Zone 1.

NOTE: Bracing shall consist of at least one vertical angle 2 inches by 2 inches by 16 gauge and one diagonal angle of the same size.

Longitudinal Sway Bracing: Longitudinal sway bracing shall be provided at 12 m (40-foot) intervals except when the location of sway braces is shown on the Drawings for the particular piping system. All runs shall have one longitudinal brace minimum. Sway braces shall be constructed in accordance with the Drawings. Branch lines, walls, or floors shall not be used as sway braces.

Vertical Runs: Vertical runs of piping shall be braced at not more than 3 m (10-foot) vertical intervals. For tubing, bracing shall be

provided at no more than 1.2 m (4-foot) spacing. Vertical braces shall be above the center of gravity of the span being braced. All sway braces shall be constructed in accordance with the Drawings. Branch lines, walls, or floors shall not be used as sway braces.

Anchor Rods, Angles, and Bars: Anchor rods, angles, and bars shall be bolted to either pipe clamps or pipe flanges at one end and cast-in-place concrete or masonry insert or clip angles bolted to the steel structure on the other end. Rods shall be solid metal or pipe as specified below. Anchor rods, angles, and bars shall not exceed lengths given in the tabulation below.

Maximum Length for Anchor Braces:

Type (kilonewtons)	Size (millimeters)	Maximum length* (meters)	Allowable Loads *
Angles	38 x 38 x 6	1.5	25.5
	50 x 50 x 6	2.0	34.5
	64 x 38 x 6	2.5	43.5
	75 x 64 x 6	2.5	48.0
	75 x 75 x 6	3.0	53.0
Rods	91	1.0	16.5
	22	1.0	22.0
Flat Bars	38 x 6	0.4	14.0
	50 x 6	0.4	18.0
	50 x 10	0.5	28.5
Pipes (40S)	25	2.0	18.0
	32	2.8	24.5
	40	3.2	29.5
	50	4.0	39.5

Type	Size (Inches)	Maximum	Allowable
Angles	1-1/2 x 1-1/2 x 1/4	4-10	5.7
	2 x 2 x 1/4	6-6	7.8
	2-1/2 x 1-1/2 x 1/4	8-0	9.8
	3 x 2-1/2 x 1/4	8-10	10.8
	3 x 3 x 1/4	9-10	11.9
Rods	3/4	3-1	3.7
	7/8	3-8	5.0
Flat Bars	1-1/2 x 1/4	1-2	3.1
	2 x 1/4	1-2	4.1
	2 x 3/8	1-9	6.2
Pipes (40S)	1	7-0	4.1
	1-1/4	9-0	5.5

1-1/2	10-4	6.6
2	13-1	8.9

* Based on the slenderness ratio of $l/r = 200$ and ASTM A 36 steel, where l is the length of the brace and r is the least radius of gyration of the brace.

Clamps and Hangers: Clamps or hangers on uninsulated pipes shall be applied directly to pipe. Insulated piping shall have clamps or hangers applied over insulation in accordance with Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

Bolts: Bolts used for attachment of anchors to pipe and structure shall be not less than 1/2 inch diameter.

3.9 SWAY BRACES FOR DUCTS

Braced Ducts: Bracing details and spacing for rectangular and round ducts shall be in accordance with SMACNA-12, including Appendix E, using Seismic Hazard Level B.

Unbraced Ducts: Hangers for unbraced ducts shall be positively attached to the duct within 2 inches of the top of the duct with a minimum of two #10 sheet metal screws. Unbraced ducts shall be installed with a 6 inch minimum clearance to vertical ceiling hanger wires.

3.10 SWAY BRACES FOR CONDUIT

Conduit shall be braced as for an equivalent weight pipe.

3.11 EQUIPMENT SWAY BRACING

Suspended Equipment: Equipment sway bracing shall be provided for items supported from overhead floor or roof structures. Braces shall consist of angles, rods, wire rope, bars, or pipes arranged as shown and secured at both ends with not less than 1/2 inch bolts. Braces shall conform to paragraph Maximum Length for Anchor Braces. Sufficient braces shall be provided for equipment to resist a horizontal force equal to 0.75 times the weight of equipment without exceeding safe working stress of bracing components. Details of equipment bracing shall be submitted for approval. In lieu of bracing with vertical supports, these items may be supported with hangers inclined at 45 degrees directed up and radially away from equipment and oriented symmetrically in 90-degree intervals on the horizontal plane, bisecting the angles of each corner of the equipment, provided that supporting members are properly sized to support operating weight of equipment when hangers are inclined at a 45-degree angle.

Floor or Pad Mounted Equipment

Shear Resistance: Floor mounted equipment shall be bolted to the floor. Requirements for the number and installation of bolts to resist shear forces shall be in accordance with paragraph ANCHOR BOLTS.

Overturning Resistance: The ratio of the height of the equipment

(measured from the base to the center of gravity of the equipment) to the minimum distance between anchor bolts shall be used to determine if overturning forces need to be considered in the sizing of anchor bolts. If this ratio is greater than 3.33 the bolt values in paragraph Minimum Bolt Sizes, Cast-In-Place Anchor Bolts shall not be used and calculations shall be provided to verify the adequacy of the anchor bolts for combined shear and overturning.

3.12 MISCELLANEOUS EQUIPMENT

Rigidly Mounted Equipment: The following specific items of equipment to be furnished under this Contract shall be constructed and assembled to withstand a horizontal lateral force of 0.15 times the operating weight of the equipment, at vertical center of gravity of the equipment without causing permanent deformation, dislocations, separation of components, or other damage, which would render the equipment inoperative for significant periods of time following an earthquake.

Rigidly Mounted Equipment:

- Boilers
- Chillers
- Air-Handling Units
- Transformers
- Motor Control Centers

Nonrigid or Flexibility-Mounted Equipment: The following specific items of equipment to be furnished shall be constructed and assembled to resist a horizontal lateral force of 0.15 times the operating weight of the equipment at the vertical center of gravity of the equipment.

3.13 LIGHTING FIXTURES IN BUILDINGS

Lighting fixtures and supports shall conform to the following:

Pendant Fixtures: Loop and hook or swivel hanger assemblies for pendant fixtures shall be fitted with a restraining device to hold the stem in the support position during earthquake motions.

Pendant-supported fluorescent fixtures shall also be provided with a flexible hanger device at the attachment to the fixture channel to preclude breaking of the support. The motion of swivels or hinged joints shall not cause sharp bends in conductors or damage to insulation.

Recessed Fluorescent Fixtures: Recessed fluorescent individual or continuous-row mounted fixtures shall be supported by a seismic-resistant suspended ceiling support system and shall be fastened thereto at each corner of the fixture with bolts or approved clips; or shall be provided with fixture support wires attached to the building structural members using two wires for individual fixtures, attached to opposite corners, and one wire per unit of continuous row mounted fixtures. Each wire support shall be capable of supporting four times the weight of the fixture. Recessed lighting fixtures not

over 56 pounds in weight and suspended or pendant-hung fixtures not over 20 pounds in weight may be supported by and attached directly to the ceiling system runners by a positive attachment such as screws or bolts, number and size as required by design seismic zone. Fixture accessories, including louvers, diffusers, and lenses shall have lock or screw attachments.

Assembly Mounted on Outlet Box: A supporting assembly that is intended to be mounted on an outlet box shall be designed to accommodate mounting features on 4 inch boxes, 3 inch plaster rings, and fixture studs.

Surface-Mounted Fluorescent Fixtures: Surface-mounted fluorescent individual or continuous-row fixtures shall be attached to a seismic-resistant ceiling support system. Fixture support devices for attaching to suspended ceilings shall be a locking-type scissor clamp or full loop band that will securely attach to the ceiling support. Fixtures attached to underside of a structural slab shall be properly anchored to the slab at each corner of the fixture.

Wall-Mounted Emergency Light Unit: Each wall-mounted emergency light unit shall be secured to remain in place during a seismic disturbance.

Lateral Force: Light fixture bracing shall be designed to resist a lateral force of 0.75 times the fixture weight.

3.14 SUSPENDED CEILING ASSEMBLIES

The structural members of ceiling support systems, used primarily to support acoustical tile panels or acoustical panel lay-in tiles, with or without lighting fixtures, ceiling-mounted air terminals, and ceiling-mounted services, shall conform to the following:

Design Loads: The main runners and cross-runners and their splices and intersection connections shall be designed for two times the design load or ultimate axial tension or compression (minimum 550 N (120 pounds)). The connections at the splices and intersections shall be of a mechanical interlocking type that cannot easily be disengaged. Ceiling structural systems shall be designed to withstand required vertical load as well as a lateral force of 11.3 percent of the ceiling weight. The ceiling weight shall include all lighting fixtures and other equipment that are laterally supported by the ceiling and shall be not less than 200 Pa (4.0 psf). Exception: Ceiling areas of 13 square meters (144 square feet) or less surrounded by walls that connect directly to the structure above will be exempt from the lateral-load standards of this specification.

Installation Requirements: Installation requirements shall be in accordance with ASTM E 580 except as follows:

Vertical Support: Hanger wires supporting a maximum tributary ceiling area of 1.5 square meters (16 square feet) shall be a minimum of 10 gauge in diameter. The size of wires supporting a tributary ceiling area greater than 1.5 square meters (16 square feet) shall be

substantiated by design calculations. Hanger attachment devices used in ceiling systems not exceeding 200 Pa (4 psf) shall be capable of supporting a minimum allowable load of 1.3 kN (300 pounds). Hanger attachment devices used in ceiling systems exceeding 200 Pa (4 psf) shall be capable of supporting the design load and shall be substantiated by design calculations. If hangers must be splayed more than one horizontal to six vertical, the resulting horizontal force shall be offset by bracing or counter-splaying, and substantiated by design calculations.

Lateral Support: In lieu of the design criteria stated above, where ceiling loads do not exceed 200 Pa, (4 psf,) lateral support for the ceiling system may be provided by four galvanized wires of minimum No. 12 gauge, as indicated in ASTM E 580, paragraph 4.4.6.

Lighting Fixture and Air Diffuser Supports: Lighting fixture and air diffuser supports shall be designed and installed to meet the requirements of equipment supports in the preceding paragraphs of this specification with the following exceptions:

Recessed lighting fixtures not over 56 pounds in weight and suspended and pendent-hung fixtures not over 20 pounds in weight may be supported and attached directly to the ceiling system runners by a positive attachment such as screw or bolts.

Air diffusers that weigh not more than 20 pounds and that receive no tributary loading from ductwork may be positively attached to and supported by the ceiling runners.

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SECTION 13110

CATHODIC PROTECTION (SACRIFICIAL ANODE)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B 418 (2001) Cast and Wrought Galvanic Zinc Anodes

NACE INTERNATIONAL (NACE)

NACE RP0169 (2002) Control of External Corrosion on Underground or Submerged Metallic Piping Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA TC 2 (2003) Electrical Polyvinyl Chloride (PVC) Tubing and Conduit

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 510 (1994; Rev thru Apr 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape

UL 514A (2004) Metallic Outlet Boxes

UL 6 (2000; Rev thru May 2003) Rigid Metal Conduit

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Evidence of qualifications of Qualified Corrosion Engineer shall be submitted in accordance with the paragraph entitled, "Services

of Corrosion Engineer," of this section.

SD-02 Shop Drawings

Installation Drawings shall be submitted in accordance with the paragraph entitled, "Shop Drawings," of this section.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

- Anodes
- Conduit
- Test Boxes and Junction Boxes
- Coatings
- Preformed Sheaths
- Epoxy Potting Compound
- Insulating Pipe Sleeves
- Electrically Insulating Pipe Joints
- Electrically Conductive Couplings
- Casing Centering Cradles and Casing Seals

SD-06 Test Reports

Test reports shall be submitted in booklet form tabulating the following field tests and measurements performed in accordance with the paragraph entitled, "Tests and Measurements," of this section.

- Static Potential-to-Soil
- Insulation Tests
- Output Measurements
- Electrode Potential Measurements
- Casing Tests
- Interference Tests

1.3 GENERAL REQUIREMENTS

Section 16003, "General Electrical Provisions," applies to work specified in this section.

1.3.1 Services of Corrosion Engineer

Contractor shall obtain the services of a corrosion engineer to supervise and inspect the installation of the cathodic protection system. Qualified Corrosion Engineer refers to a person, who, by reason of his knowledge of the physical sciences and the principles of engineering and mathematics acquired by professional education and related practical experience, is qualified to engage in the practice of corrosion control on buried or submerged metallic piping systems and metallic tanks. Such person may be a licensed professional engineer or may be a person certified by the National Association of Corrosion Engineers if such licensing or certification includes suitable experience in corrosion control on buried or submerged

metallic piping systems and metallic tanks. Corrosion engineer's name and qualifications shall be certified in writing to the Contracting Officer for approval prior to the start of construction.

Corrosion engineer shall ensure that the cathodic protection system is installed, tested, and placed into service in accordance with the requirements specified.

1.3.2 Rules

Installation shall conform to the requirements of NFPA 70.

1.4 DELIVERY, STORAGE, AND HANDLING

Storage area for anodes will be designated by the Contracting Officer. If anodes are not stored in a building, tarps or similar protection shall be used to protect anodes from inclement weather. Package anodes, damaged as a result of improper handling or exposure to rain, shall be resacked by the Contractor and the required backfill added.

PART 2 PRODUCTS

2.1 ANODES

2.1.1 Zinc Anodes

TYPICAL ZINC ANODE SIZES

<u>NOMINAL BARE WEIGHT (LB.)</u>	<u>NOMINAL BARE ANODE DIMENSIONS (IN.)</u>	<u>GROSS WEIGHT PACKAGED IN BACKFILL</u>
5	1.4 X 1.4 X 9	15
12	1.4 X 1.4 X 24	35
18	1.4 X 1.4 X 36	50
30	1.4 X 1.4 X 60	80
30	2 X 2 X 30	60
45	2 X 2 X 45	85
60	2 X 2 X 60	105

Zinc anodes shall conform to the requirements of ASTM B 418, Type II.

2.1.2 Connecting Wire

Wire shall be AWG No. 12 solid copper wire, not less than 10 feet long, unsplined, complying with NFPA 70, Type TW insulation. Connecting wires for zinc anodes shall be factory installed with the place of connection to the protruding steel core completely sealed with a dielectric material.

2.1.3 Artificial Backfill

Anodes shall be factory packaged with an artificial backfill in a water-permeable fabric sack or cardboard container. Anodes shall be

packaged on a vibrating platform to attain dense packing. Centering shall be assured by means of spacers.

Artificial backfill shall have the following composition:

<u>Material</u>	<u>Approximate Percent by Weight</u>
Gypsum	75
Bentonite	20
Sodium Sulfate	<u>5</u>
Total	100

2.2 ELECTRICAL WIRE

Wire shall be AWG No. 8 stranded copper wire with Type TW insulation conforming to NFPA 70.

2.3 ELECTRICAL CONNECTIONS

Connecting wire splicing shall be performed by the use of copper compression connections or exothermic welds. Split-bolt connections shall be used only if compression connections or exothermic welded connections are not possible. Where split-bolt connections are necessary, a minimum of two split bolts shall be used.

2.4 CONDUIT

Rigid galvanized steel conduit and accessories shall conform to UL 6. Non-metallic conduit shall conform to NEMA TC 2.

2.5 TEST BOXES AND JUNCTION BOXES

Boxes shall be outdoor type conforming to UL 514A.

2.6 JOINT, PATCH, SEAL, AND REPAIR COATINGS

Sealing and dielectric compound shall be a black, rubber-based compound that is soft, permanently pliable, tacky, moldable, and unbacked. Compound shall be applied as recommended by the manufacturer, but not less than 1/2-inch thick.

Coating compound shall be an approved pipeline wrapping.

Pressure-sensitive vinyl plastic electrical tape shall conform to UL 510.

2.7 PREFORMED SHEATHS

Sheaths for encapsulating electrical wire splices to be buried underground shall fit the insulated wires entering the spliced joint.

2.8 EPOXY POTTING COMPOUND

Compound for encapsulating electrical wire splices to be buried underground shall be a two-package system made for the purpose.

2.9 TEST STATIONS

Stations shall be flush mounted type and shall be made of high impact molded glass filled polycarbonate with watertight conduit connections and shall have lockable cover with a cast-in legend, "C.P. Test".

Stations shall be watertight so that electrical terminals are maintained in a dry environment when cabinet is submerged under water.

Stations shall be furnished with a five lead terminal board with terminals accessible from both sides. Terminal board shall be designed for easy removal from the housing to permit above the "surface of the ground" access for taking test readings.

Stations shall have color-coded covers for identification of the following underground piping systems.

<u>PIPING SYSTEM</u>	<u>COLOR CODED COVER</u>
Natural Gas	Yellow
Potable Water	White
Cooling Tower Water	Brown
Service Air	Black
Combustion Air	Gray

Stations shall be maintenance free and all hardware such as machine screws, washers, and hex nuts shall be brass.

Stations shall be designed and constructed for dimensional and electrical stability from minus 60 degrees F to plus 250 degrees F.

2.10 PAVEMENT INSERTS

Pavements inserts shall be used to permit access to soil under paved areas for taking future pipe-to-soil potential readings over existing underground piping systems.

Pavement inserts shall be of the same construction and design as the test stations and shall be designed to be embedded in streets or sidewalks in urban and high vehicular traffic areas.

Pavement inserts shall be designed for flush mounting in paved areas.

Pavement inserts shall have color-coded covers to match color coding for test stations for identification of the underground piping systems.

Pavement inserts shall be maintenance free and hardware shall be brass or stainless steel.

2.11 INSULATING PIPE SLEEVES

Insulating pipe sleeves shall be provided between metallic piping and metal buildings, hangers, supports and other metal structures. Insulating sleeve

shall completely surround the metallic pipe for the full length of the steel contact and shall effectively prevent contact between the cathodically protected metallic pipe and other metallic structures. Insulation material shall be micarta, plastic, PVC, or other suitable insulating material.

Insulating supports must prevent damage to the pipeline coating and accommodate relative movement, vibrations and temperature differentials.

2.12 ELECTRICALLY INSULATING PIPE JOINTS

Electrically insulating pipe joints for above or below ground use shall be flexible, mechanical pipe couplings of an electrically insulating type consisting of bolted or compression design provided with electrically insulating joint harness if required to provide pull-out strength non-flexible flanged type electrically insulating pipe joints to be field assembled.

Threaded type electrically insulating pipe joints shall have molded plastic screw threads and shall only be used above ground. Machined plastic screw threads shall not be used.

Electrically insulating pipe joints shall be of a type that is in regular factory production.

2.12.1 Dielectric Unions

Dielectric unions shall conform to the requirements of ASME B16.39. Class designation for dimensional, strength and pressure requirements shall conform to the specified requirements for the piping system in which the union is to be installed. Insulating barrier shall limit galvanic current to one percent of the short circuit current in a corresponding metallic joint.

2.12.2 Flange Insulating Kits

Class designation for dimensional, strength, and pressure requirements shall conform to the specified requirements for the piping system in which the flange insulation set is to be installed.

Flanges in pipelines shall be electrically insulated by inserting an insulating gasket between the two flange faces. Insulating gaskets may have the same outside diameter as the flange, may fit within the bolt circle of the flange faces, or may fit into the ring groove of ring type joint flanges. Flange coupling securing bolts shall be insulated from the flange face bolt holes by installing insulating sleeves over the shanks of the bolts and insulating washers and steel washers under the bolt heads and nuts. Insulating bolt sleeves shall be of sufficient length to extend half way inside the steel washer. Insulating sleeves and washers may be combined as a one piece unit.

2.12.2.1 Gasket Materials

Gaskets shall be manufactured from material having low water absorption and

high compressive strength. Preference shall be given to materials with low "m" and "y" factors. The "y" factor is a measure of the compressive load required to establish an initial seal, while the "m" factor is an indication of the additional load required to hold fluid pressure needed to keep the seal in operation. The smaller these factors are, the less bolt loading is required.

2.12.2.2 Insulating Bolt Sleeve and Washer Materials

Insulating bolt sleeves and washers shall be manufactured from material having low water absorption, high dielectric strength, and low cold flow characteristics. They should be suitable for the service conditions of the particular application.

2.13 ELECTRICALLY CONDUCTIVE COUPLINGS

Electrically conductive couplings shall be of a type that has a published maximum electrical resistance rating given in the manufacturer's literature.

2.14 CASING CENTERING CRADLES AND CASING SEALS

Cradles and seals shall be of a type that is in regular factory production made for the purpose of electrically insulating the carrier pipe from the casing and preventing the incursion of water into the annular space.

PART 3 EXECUTION

3.1 INSTALLATION

All equipment shall be installed in accordance with the manufacturer's recommendations.

3.1.1 Anodes

Anodes of the size indicated shall be installed at the locations shown. Locations may be changed to clear obstructions if approved. Anodes shall be installed as indicated in a dry condition after any plastic or waterproof protective covering has been completely removed from the water permeable, permanent container housing the anode metal. Anode connecting wire shall not be used for lowering the anode into the hole. Annular space around the anode shall be backfilled with fine earth in 6-inch layers and each layer shall be hand tamped. Care must be exercised not to strike the anode or connecting wire with the tamper. Approximately 5 gallons of water shall be applied to each filled hole after anode backfilling and tamping has been completed to a point about 6 inches above the anode. After the water has been absorbed by the earth, backfilling shall be completed to the ground surface level.

In the event a rock strata is encountered prior to achieving specified augured hole depth, the Contractor shall notify the Contracting Officer. With the Contracting Officer's approval, the Contractor may then install the anodes horizontally to a depth at least as deep as the bottom of the pipe to be protected.

Anodes shall be installed a minimum of 3 feet and a maximum of 10 feet from the line to be protected.

Single anodes spaced as shown shall be direct connected to the pipeline, allowing adequate slack in the connecting wire to compensate for movement during backfill operation.

Groups of anodes, in quantity and location shown, shall be connected to a collector cable. Collector cable shall only make contact with the structure to be protected through a test station.

Resistance wires shall not be used to reduce the current output of individual or group anodes.

Connections to ferrous pipe shall be made by exothermic weld methods manufactured for the type of pipe.

Electric arc welded connections and other types of welded connections to ferrous pipe and structures shall be approved before use.

3.1.2 Anode Lead Connections

If the anode lead wire is not of sufficient length to connect the anode to the pipe or test station, an additional length of AWG No. 8 stranded copper wire shall be added and spliced to the anode lead wire using a homogeneous exothermic welding process. Splice shall be insulated with two half-lapped layers of 3/4-inch wide rubber tape and two half-lapped layers of 3/4-inch wide polyethylene tape.

Connections of anode lead wire to pipe shall be made by an approved exothermic welding process following the instructions of the manufacturer. Installation shall be in strict accordance to manufacturer's recommendations.

Before the anode lead connection is made, the pipe shall be inspected to verify that the condition of the pipe is sound for making an exothermic weld. If the condition of the pipe is proven to be sound, the pipe connection area shall be cleaned to bare metal by means of scraping, filing or other approved methods. Cleaning of the pipe shall be by manual methods and no power-driven wheels or wire brushes shall be used.

Before the anode lead connection is made to a natural gas pipeline, an approved gas leak detector shall be used to determine if there is any gas leakage near the pipe area to be welded. Should a gas leak be discovered, it shall be brought to the immediate attention of the Contracting Officer. Connection shall not be made until the leak is properly repaired and an alternative safe location for the connection is approved by the Contracting Officer and the Contractor's corrosion specialist.

After the anode lead or test lead to pipe connections have been made, they shall be covered with mastic sealant and plastic shield.

Anode lead connection to test station terminals shall be made with insulated compression ring terminals.

3.1.3 Test Stations

Test stations shall be of the type shown and installed at the location shown and shall be post mounted. Buried electrically insulating joints shall be provided with test wire connections brought to a test station. Unless otherwise shown, other test stations shall be located as follows:

- a. At 1,000-foot intervals or less.
- b. Where the pipe or conduit crosses any other metal pipe.
- c. At both ends of casings under roadways and railways.
- d. Where both sides of an insulating joint are not accessible above ground for testing purposes.

Test stations shall be installed with color-coded covers to identify the piping system on which it is installed as specified in this specification. Each new test station shall be identified by number as depicted on the drawings. Contractor shall furnish and install a screw mounted 2-inch round brass identifying tag with 1/2-inch stamped characters onto each test station cover.

Location of the pipeline in relation to the test station shall be indicated by an arrow inscribed in the concrete base of the test station.

3.1.4 Pavement Inserts

Pavement inserts shall be flush mounted and installed in paved areas as shown on the drawings. Inserts shall be installed with color-coded covers to identify the piping system on which it is installed as specified in this specification.

Pavement inserts shall be installed as closely as possible over the center line of underground pipeline to permit accurate evaluation of future pipe-to-soil potential surveys. Contractor shall use and furnish all necessary labor and pipe location equipment to locate and mark center lines of underground piping systems. Use of reference dimensions on contract drawings shall not be used for determining the center lines of underground piping systems.

3.2 CRITERIA OF PROTECTION

Criteria for determining the adequacy of protection on a buried pipe shall be in accordance with NACE RP0169 and shall be selected by the corrosion engineer as applicable.

3.2.1 Iron, Steel, Bronze (which may include water, gas or other underground utilities, applies to valves, joints or other unprotected fittings))

One of the following methods shall apply:

3.2.1.1 850 MV Negative Voltage

A negative voltage of at least minus 0.85 volt as measured between the pipe and a saturated copper-copper sulfate reference electrode contacting the earth directly over the pipe. Determination of this voltage shall be made with the cathodic system in operation.

3.2.1.2 300 MV Negative Voltage

A negative voltage shift of at least 300 millivolts as measured between the pipe and a saturated copper-copper sulfate reference electrode contacting the earth directly over the pipe. Determination of this voltage shift shall be made with the protective current applied. These criteria apply to pipes not in electrical contact with dissimilar metals.

3.2.1.3 100 MV Polarization Voltage

A minimum polarization voltage shift of 100 millivolts as measured between the pipe and a saturated copper-copper sulfate reference electrode contacting the earth directly over the pipe. This polarization voltage shift shall be determined by interrupting the protective current and measuring the polarization decay. When the protective current is interrupted, an immediate voltage shift will occur. Voltage reading, after the immediate shift, shall be used as the base reading from which to measure polarization decay.

3.3 TESTS AND MEASUREMENTS

3.3.1 Baseline Potentials

After backfill of the pipe and anodes is completed, but before the anodes are connected to the pipe, the Static Potential-to-Soil of the pipe shall be measured. Locations of these measurements shall be identical to the locations specified for pipe-to-reference Electrode Potential Measurements. Initial measurements shall be recorded.

3.3.2 Insulation Testing

Before the anode system is connected to the pipe, Insulation Tests shall be made at each insulating joint or fitting. This test shall demonstrate that no metallic contact, or short circuit exists between the two insulated sections of the pipe. Any insulating fittings installed and found to be defective shall be reported to the Contracting Officer.

3.3.3 Anode Output

As the anodes or groups of anodes are connected to the pipe, current Output Measurements shall be taken with an approved low resistance ammeter. Values obtained and the date, time, and location shall be recorded.

3.3.4 Pipe-To-Reference Electrode Potential Measurements

Upon completion of the installation and operation of the entire cathodic protection system electrode potential measurements shall be made using a

copper-copper sulfate reference electrode and a potentiometer-voltmeter, or a direct current voltmeter having an internal resistance (sensitivity) of not less than 100,000 ohms per volt and a full scale of 1 or 2 volts. Locations of these measurements shall be identical to the locations used for the baseline potentials. Values obtained and the dates, times, and locations of measurements shall be recorded.

3.3.5 Location of Measurements

3.3.5.1 Piping or Conduit

For coated piping or conduit, measurements shall be taken from the reference electrode in contact with the earth, directly over the pipe. Connection to the pipe shall be made at service risers, valves, test leads, or by other means suitable for test purposes. Measurements shall be made at intervals not exceeding 400 feet. In no case shall less than three measurements be made over any length of line. Additional measurements shall be made at each distribution service riser, with the reference electrode placed directly over the service line.

3.3.6 Casing Tests

Electrical separation of carrier pipe from casings shall be tested and any short circuits corrected.

3.3.7 Interference Tests

Before final acceptance of the installation, interference tests shall be made with respect to any foreign pipes in cooperation with the owner of the foreign pipes. A full report of the tests giving all details shall be made.

3.3.8 Recording Measurements

All pipe-to-soil potential measurements including initial potentials, where required, shall be recorded. Contractor shall locate, correct and report to Contracting Officer any short circuits to foreign pipes encountered during checkout of the installed cathodic protection system. Pipe-to-soil potential measurements are required on as many pipes as necessary to determine the extent of protection or to locate short-circuits.

3.4 PIPE JOINTS

3.4.1 Electrical Continuity

Underground pipe shall be electrically continuous except at places where electrically insulating joints are specified. Pipe joined by means other than welding shall meet electrical continuity requirements.

The following mechanical joints that are not factory designed to provide electrical continuity shall be bonded by installing a metallic bond across the joint. Bonding connections shall be made by the exothermic welding process.

Mechanical joints designed to provide electrical continuity shall meet

manufacturer's published standards.

3.4.2 Coating

Mechanical joints and fittings of either the electrically conductive or insulating type shall be coated with an underground type dielectric coating system. Where external electrical continuity bonds are installed across mechanical joints, all bare or exposed metal, welds, bare wire and exposed coupling parts shall be coated with a coating system.

Couplings and fittings which have a low profile exterior designed to permit tape coating shall be primed and wrapped with an underground type pipe tape following recommendations of the coupling or fitting manufacturer.

Couplings and fittings that cannot be properly taped shall be enclosed in a shroud of reinforced kraft paper and filled with polyurethane foam having a cellular structure that will not absorb water.

3.5 ELECTRICAL ISOLATION OF STRUCTURES

3.5.1 Insulating Fittings

Insulating flanges and couplings shall be installed above ground, or within manholes, wherever possible. An insulating device that electrically separates a pipeline shall not be installed in a confined area where a combustible atmosphere may collect, unless precautions are taken to prevent arcing, such as by means of externally located lightning arresters, grounding cells, or other means. Insulating flanges and couplings in lines entering buildings shall be located at least 12 inches above grade or floor level. Pipelines entering buildings either below or above ground shall be electrically isolated from the structure wall with an electrically isolating wall sleeve.

3.5.2 Electrical Isolation

Steam, High Temperature, Water, and Line Conduit: electrical isolation shall be provided at each building entrance, and at other locations as indicated.

3.6 DISSIMILAR METALS

3.6.1 Underground Dissimilar Piping

Buried piping of dissimilar metals including new and old steel piping, excepting valves, shall be electrically separated by means of electrically insulating joints at every place of connection. Insulating joint, including the pipe, shall be coated with an underground type dielectric coating for a minimum distance of 10 diameters on each side of the joint.

3.6.2 Underground Dissimilar Valves

Dissimilar ferrous valves in a buried ferrous pipeline, including the pipe, shall be coated with an underground type dielectric coating for a minimum distance of 10 diameters on each side of the valve.

Brass or bronze valves shall not be used in a buried ferrous pipeline.

3.6.3 Above ground Dissimilar Pipe and Valves

If the dissimilar metal pipe junction, including valves, is not buried and exposed only to atmosphere, the connection or valve, including the pipe, shall be coated with an underground type dielectric coating for a minimum distance of three diameters on each side of the junction.

3.7 CASING

Where a pipeline is installed in a casing under a roadway or railway, the pipeline shall be electrically insulated from the casing and annular space sealed against incursion of water.

3.8 SHOP DRAWINGS

Installation Drawings shall be submitted for cathode protection systems consisting of a complete list of equipment and materials including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will function properly as a unit.

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SECTION 13852

FIRE-ALARM SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2003) Life Safety Code (National Fire Codes, Vol 5)
NFPA 70	(2002) National Electrical Code
NFPA 72	(2002) National Fire Alarm Code
NFPA 90A	(2002) Standard for the Installation of Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 268	(2004) UL Standard for Safety Smoke Detectors for Fire Protective Signaling Systems
UL 38	(2001) UL Standard for Safety Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems

1.2 SYSTEM REQUIREMENTS

Fire-alarm system shall be a supervised, addressable, noncoded electrical alarm system with NFPA 72 Class 'A', Style 'D' initiating device circuits and NFPA 72 Class A Style signaling line circuits with control units electrically connected to sound the general alarm continuously upon operation of one or more initiating devices with remote reporting circuits.

Notification Appliance Circuits shall be Class 'A', Style 'Z'. This system shall conform to the applicable requirements of NFPA 72, NFPA 70, NFPA 90A and NFPA 101.

System component installation in hazardous facilities shall be in accordance with NFPA 70.

Each circuit shall be individually and independently arranged so that an open circuit, a ground, or an open circuit and a ground occurring at the

same time in the circuit will not prevent the transmission of a clear and intelligible alarm signal before the trouble is cleared.

Circuits shall be electrically supervised through closed-loop circuits to detect interruptions, shorts, or ground faults and report these as trouble.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists shall be submitted in accordance with paragraph entitled, "Fire Alarm Systems," of this section.

SD-02 Shop Drawings

Schematics shall be submitted by the Contracting Officer in accordance with paragraph entitled, "Alarm Control Units," of this section.

Installation drawings shall be submitted for fire-alarm and detection systems in accordance with the paragraph entitled, "Installation," of this section.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

- Fire Alarm Systems
- Alarm Control Units
- Heat-Actuated Detectors
- Product-Of-Combustion Detectors
- Manual Alarm Stations
- Audio Alarms
- Wiring and Raceway
- Revolving Beacon
- Strobe Lights
- Transceiver, antennae and all associated devices
- Software for New System

SD-05 Design Data

Design analysis and calculations shall be submitted for fire-alarm and detection systems in accordance with paragraph's entitled, "Fire Alarm Systems" and "Alarm Control Unit."

Listing of Product Installations for fire-alarm and detection systems shall be submitted in accordance with paragraph entitled, "Installation," of this section.

SD-06 Test Reports

Test reports shall be submitted for Fire-Alarm and Detection Systems for the following field tests in accordance with the paragraph entitled, "External System Wiring," of this section.

Preliminary Tests
Acceptance Test
Ground Detection Test
Standby Power Test
Trouble Test

SD-07 Certificates

Certificates from the manufacturer shall be submitted for the following items showing conformance with the referenced standards contained in this section.

Fire Alarm Systems
Alarm Control Units
Heat-Actuated Detectors
Product-Of-Combustion Detectors
Manual Alarm Stations
Audio Alarms
Wiring and Raceway
Revolving Beacon
Strobe Lights
Transceiver, antennae and all associated devices
Fire Alarm Contractor Qualifications

1.4 QUALITY ASSURANCE

Equipment to be provided shall be the standard catalog product of a manufacturer regularly engaged in the manufacture of fire-alarm equipment. Fire-alarm equipment shall be the latest standard design and approved by Underwriters' Laboratories. Devices shall be approved by the control panel manufacturer and fire alarm authority having jurisdiction for use with the new panel.

1.5 FIRE ALARM CONTRACTOR QUALIFICATIONS

An experienced installer who is an authorized representative of the FACP manufacturer for both installation and maintenance of units required for this Project.

Installation of fire alarm detection systems, fire protection suppression systems, and any of the components, all technician(s) installing this equipment, cabling, etc. must be licensed in the State of Montana and hold the proper endorsement of such installation. The licenses and endorsements are as follows.

SAF = Sell, Service or Install Fire Alarm Systems
SEF = Sell, Service of Install Extinguishing Systems

SAFS = Sell, Service of Install Special Agent Fire Suppression System

A licensed journeyman electrician can install fire alarm systems and its components if the above endorsements are stamped on their license and factory trained, or NICET II certified and factory trained in the installation of the fire alarm devices being installed. The installer must be NICET II certified and licensed with the State of Montana licensing program to inspect, test, and certify the operational condition of the system. All licensees, endorsements and NICET certifications must be presented to the contracting officers and the fire prevention officers (341 CES/CEFT and the company name and personnel name(s) installing the system before work is to begin

All fire alarms, fire suppression, and special agent systems must be installed IAW the appropriate NFPA (National Fire Protection Association Code) 13, 13A, 17, 17A, 24, 25, 72, 101 and any other code reference mentioned in contract specifications, manufacturer's recommendations and construction drawings. Current licenses, endorsements, and NICET certification must be on file with the Department of Commerce, Professional and Occupational Licensing Bureau, 11 North Jackson, P.O. Box 200513, Helena, MT 59620-0513

All fire alarm and detection systems, fire suppression systems, special hazard fire detection and suppression systems will come with a one year warranty and an emergency recall service (manufacturers representative must be able to respond within 20 minutes) for repair and service when notified

Manufacturer Qualifications: A firm experienced in manufacturing systems similar to those indicated for this Project and with a record of successful in-service performance.

Source Limitations: Obtain fire alarm system components through one source from a single manufacturer

PART 2 PRODUCTS

2.1 FIRE ALARM SYSTEMS

Fire alarm system shall contain, but not be limited to,:

- Alarm control units

- Emergency battery and charger unit

- Remote Reporting Devices

- Combination fixed temperature and rate-of-rise detectors

- Product-of-combustion detectors including air handling unit (AHU) duct detection

- Rate compensation detectors

- Manual alarm stations

Alarm speakers

Audio/visual indicators

Revolving beacons/strobes

Water-flow switches

Auxiliary components and devices

Raceways

Wiring, and associated circuitry

Water pressure switches

Air handler controls

Ventilating system control

Material, Equipment, and Fixture Lists shall be submitted for fire-alarm and detection systems including manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site information.

Design analysis and calculations shall be submitted for fire-alarm and detection systems consisting of detector installation location analysis and calculations, and battery capacity and loading calculations to verify the requirements listed in this section. Adequacy of audibility of signals provided shall be provided. If additional audible signals are required Contractor shall bid as such and provide

2.2 ALARM CONTROL UNITS

Alarm unit shall be comprised of 198 active devices, expandable to 301. Unit shall have the number of addresses required to perform as specified herein.

Alarm control unit shall contain power-on, fire and trouble indicating lights that are plainly visible when the cabinet is closed. Unit shall also contain the alarm silence switch, the trouble silence switch, the power on-off switch, and the alarm/trouble reset switch, and shall be accessible only by unlocking and opening the unit.

Alarm control unit shall function when a detector or manual alarm station or water-flow switch or any other initiating device connected to the unit is activated. Fire-alarm indicator and alarm-control circuits shall energize and activate the external audible and visible signal and auxiliary devices, providing indication and sending an alarm signal to the remote central station fire monitoring system.

Control unit shall contain components and circuitry to operate a local annunciator and auxiliary devices such as air handlers, ventilating fans,

and damper solenoids.

Control unit shall report the following conditions as trouble: open supervised circuits, ground faults, loss of primary power, power supply anomalies, low battery voltage, loss of battery voltage, and activation of the alarm silence switch. These troubles shall activate the trouble indicator and a trouble buzzer located within the cabinet, provide address indication where applicable, and send a trouble signal to the central station fire monitoring system.

Control unit shall be capable of receiving and broadcasting a live voice message. Voice message shall be intelligible (as defined by NFPA 72) and shall be measured in accordance with IEC 60849, Sound Systems for Emergency Services and IEC 60268, Part 16, The Objective Rating of Speech Intelligibility by Speech Transmission Index. Contractor shall verify intelligibility and provide verification of such in shop drawings submittals. If additional audible signals are required by manufacturer submitting system, signals shall be included in initial bid and shop drawing submittal.

Schematics consisting of ladder diagrams of control system showing interaction of components as a system shall be submitted for approval prior to installation.

Module schematic drawings, minimum size 11 inches by 17 inches, shall also be submitted prior to system acceptance testing.

Software: The Government (Civil Engineering Alarm Shop) must receive all software and manuals for the alarm system. The software shall allow the Government to add or remove any device to/from the system. The software shall be based on and operate on Microsoft Windows Operating System, (DOS systems shall not be acceptable). The Contractor shall provide any special wire devices to use the software, such as interface cables between the FACP and a laptop computer (RS-232 compatible) and any necessary hardware keys and/or passwords required to allow access to the software. The Government shall also receive any and all passwords to allow full access to the panel. The software shall be the original version, and shall not be a copy of this software. The Government shall receive all licensing and full rights of use of the software.

Download/Upload: The system shall provide the ability to upload the database to a laptop computer. The FACP shall have the built-in capability to download and upload the fire alarm database to/from a 3.5-inch floppy disk.

2.2.1 Alarm Control Unit Switches

Power on-off switch shall disconnect all power sources, 120 V(ac) and 24 V(dc), to the control panel.

Alarm/trouble reset switch shall reset the detector system in alarm or trouble. Trouble signals shall not be self-restoring without activating the reset switch.

Alarm and trouble silence switches shall silence the alarm and trouble audibles. Either switch placed in other than the normal position shall provide the following:

Report as a trouble to the central station fire monitoring system.

Transfer audible noise to a panel lamp visual indication.

Re-ring the trouble audible when the problem has been cleared but the switch has been left in the silence position.

When the alarm silencing switch is in the silence position, subsequent alarms shall operate the alarm-sounding devices.

Alarm-control unit shall be UL listed and approved for use with the detectors and manual alarm stations and other fire alarm devices.

2.2.2 Control Relays

Relays shall be supervised, continuous duty, have self-cleaning contacts of silver or an alloy of equivalent performance, and be UL approved for system use. Supervisory relays shall be protected against dust by individual covers. Relays that provide external functions such as remote reporting, control device activation, signal lights, and bells shall have at least one set of spare contacts. Relays shall be permanently marked with the coil resistance, operating-current range, and internal pin connections identified by standard pin numbers.

2.2.3 Enclosure

Control-unit cabinet shall be steel and shall be provided with a hinged cover and an integral pin-tumbler cylinder lock. Cabinet shall be painted with a prime coat and finish coat of scratch-resistant baked red enamel in accordance with manufacturer's instructions.

An etched metal identification plate shall be affixed to the cabinet door of the alarm-control unit to identify the cabinet as a fire-alarm cabinet. Cabinet shall be semi-flush mounting and contain all batteries required

2.2.4 Alarm Control Panel

Alarm control panel shall have supervised normally closed, dry, single pole double throw (SPDT) contact that opens for trouble conditions and a normally open, dry, SPDT contact that closes for alarm conditions. Conductors shall be installed from these contacts to alarm transceiver.

System Alarm Capability during Circuit Fault Conditions: Addressable system shall have the following performance characteristics: IDC - Class 'A', Style 'D'; NAC - Class 'A', Style 'Z'; SLC - Class 'A', Style '6'.

Control units shall be provided with a battery backup automatically switched alternate power source. Interruption of primary power shall cause the unit to switch automatically to the alternate power source and initiate a trouble signal.

Backup battery shall be capable of operating the alarm control unit in normal supervisory condition for 24 hours, minimum. An alarm signal receipt during battery backup operation shall cause an alarm signal to be sent via the remote report circuit and shall sound the local alarm-signaling appliances for 15 minutes, minimum.

Alarm control unit shall be able to operate on facility power when the backup batteries are disconnected for any reason. A system trouble signal shall be sent if the battery is disconnected or has low voltage.

System shall be capable of broadcasting field-programmable evacuation messages in addition to at least four factory programmed messages. Messages shall be stored on nonvolatile memory. System shall also be capable of delivering a live voice message via a secure microphone (located in locked control panel).

2.3 HEAT-ACTUATED DETECTORS

Heat-actuated detectors (HADs) shall be rated 136 degrees F fixed temperature and 15 degrees F per minute rate-of-rise. HADs shall be self-restorable for the rate-of-rise feature and nonrestorable for fixed temperature.]

HADs shall have a set of normally open contacts that close to initiate an alarm. Components of the HADs shall be rust- and corrosion-resistant.

Non-restorable detectors shall have a visual identifier to show when device has been expended to facilitate replacement.

2.4 PRODUCT-OF-COMBUSTION DETECTORS

Detectors shall operate on the smoke obscuration principle and shall be activated by the presence of combustion gases, invisible particles, or visible smoke particles. Detectors shall include a molded base, detector head, and locking means. Smoke detectors shall conform to UL 268.

Detector heads shall be plug-in units and shall contain no moving parts. Replacements or readjustments shall not be required to restore it to normal operation after an alarm has been given. Sensitivity shall be adjustable to compensate for ambient operating conditions.

Base shall have terminals for making connections and shall incorporate a light emitting diode or neon indicator that shall provide a visual indication when the detector initiates an alarm. Base shall contain the receptacle for the plug-in detector head. Components of the detectors shall be rust- and corrosion-resistant.

2.5 MANUAL ALARM STATIONS

Manual alarm stations shall be break-glass alarm-initiating devices designed in accordance with UL 38 for use with automatic and manual fire alarm systems.

Station door shall have a protected, pull-down operating lever with finger grip that does not project out from the front of the case.

Terminal blocks shall be readily accessible from station front.

Stations shall be the noncoded type which, when operated, close one or more sets of contacts and lock the contacts in the operated position until reset. Stations with a pushbutton that depend upon a spring-loaded device to close the contacts when the handle is pulled are not acceptable. Stations shall not be resettable without the use of a key. Exposed metal surfaces of enclosing cases shall be painted with a prime coat and finish coat of red enamel to produce a smooth, hard, durable finish. Identification and directions for operating manual-alarm stations shall be provided on the cover in raised or depressed white-enameled letters. Plastic or composite material is not acceptable.

Surface-mounted stations shall be furnished with matching [cast-iron] [cast-aluminum] back boxes with top and bottom threaded-conduit connections.

Manual alarm stations shall be positioned so that they are readily accessible. Locations shall comply with NFPA 101 and NFPA 72.

A flush pin-tumbler cylinder lock and key shall be provided on general alarm type stations to sound the general alarm for fire drill or test without breaking the glass rod in the latching mechanism. Locks on manual alarm stations shall be keyed alike.

2.6 ALARM SPEAKER/STROBE

Speaker/Strobe shall be UL 1480 and UL 1971 Listed and be approved for fire protective signaling systems. Speaker shall be capable of operating at 25.0 or 70.7 nominal VRMS, and shall have a frequency range of 400-4000 Hz.

Speaker shall have power taps that are selected by DIP switch. The strobe shall consist of a xenon flash tube with associated lens/reflector system and operate on either 12 volts or 24 volts. The strobe shall also feature selectable-candela output, providing options for 15 or 15/75 candela when operating on 12 volts; and 15, 15/75, 30, 75, or 110 when operating on 24 volts. The strobe shall comply with the Americans with Disabilities Act requirement for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range.

2.7 WIRING AND RACEWAY

Wiring materials shall conform to the requirements of NFPA 70 copper wiring.

2.8 POWER SOURCE

Normal power for the local systems for all purposes shall be 120 volts, 60 hertz. System shall operate when supplied with 85 to 110 percent of normal voltage. Source shall be on the load side of the facility main. Fire alarm shall be on a dedicated branch circuit.

Fire-alarm-system disconnect and protective device shall be a circuit breaker and shall be red with a factory finish. In addition, the device

shall be marked "FIRE-ALARM DISCONNECT" with 1/2-inch high letters in white paint or engraved phenolic identification plate fastened to the device with sheetmetal screws.

2.9 REVOLVING BEACON

Revolving beacon for use as a fire warning light shall be capable of accepting 75-watt sealed-beam spot lamps. Each lamp shall project its beam downward on a reflector that rotates 360 degrees 60 times per minute at a 45-degree angle. Lens shall be a heat-resistant red plastic dome. Unit shall be suitable for upright mounting on conduit sized 1/2-inch minimum.

2.10 ALARM TRANSCEIVER

New Monaco BT2-4 narrowband transceiver compatible with existing base wide D-500 radio alarm system. Provide new antenna, lightning arrestor kit, cable, etc. compatible with existing D-500 system.

Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP, or from its own internal sensors or controls, and automatically transmits signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. The message transmitted corresponds to standard designations for the fire-reporting system to which the signal is being transmitted and includes separately designated messages in response to the following events or conditions:

Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.

System Test Message: Initiated by a manual test switch within the transmitter cabinet or automatically, at an optionally preselected time, once every 24 hours with transmission time controlled by a programmed timing device integral to transmitter controls.

Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source or derangement of the wiring of the transmitter or any alarm input interface circuit or device connected to it.

Local Fire Alarm System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.

Local Fire Alarm System Alarm Message: Actuated when the building system goes into an alarm state. Identifies zone or device that initiated the alarm.

Local Alarm System Supervisory Alarm message: Actuated when the building alarm system indicates a supervisory alarm.

PART 3 EXECUTION

3.1 SYSTEM SEQUENCE OF OPERATION

3.1.1 Normal Operation

All switches shall be in the normal position. Available power lamp shall be "ON" and the trouble and detector identification lamps shall be "OFF." All circuits shall be electrically supervised.

3.1.2 Alarm Condition

Detectors, manual alarm stations, water flow switches, or other alarm devices shall close a contact that activates the appropriate alarm control unit. Alarm control unit shall transmit a signal to a remote reporting device of the base fire alarm system, activate the building alarm audible signals, provide address indication control air-handling and ventilating units, and provide indication or control to other devices.

3.1.3 Trouble Condition

System conditions, identified in the paragraph entitled, "Alarm-Control Unit," that will transmit a trouble signal to the remote reporting device of the base fire alarm system, shall provide address indication when used, activate a trouble signal in the alarm-control unit, and provide input to remote annunciators when used. Trouble signal in the alarm-control unit shall be comprised of a trouble lamp and buzzer.

3.2 INSTALLATION

Manufacturer's catalog data shall be submitted for Software for New System.

Listing of Product Installations for fire-alarm and detection systems shall include identification of at least 5 units, similar to those proposed for use, that have been in successful service for a minimum period of 5 years. List shall include purchaser, address of installation, service organization, contact at said organization and date of installation.

3.2.1 Alarm-Control Units

An alarm-control unit, complete with accessories and devices, shall be installed in each protected building.

3.2.2 Product-of-Combustion Detectors

Product-of-combustion detectors shall be installed in accordance with applicable NFPA standards. Smoke detectors shall be installed after the work of other trades has been accomplished.

3.2.3 Manual Alarm Stations

Manual stations shall be mounted 48-inches above the finished floor level to actuating lever.

3.2.4 Signals

Speakers shall be mounted 7-feet above the finish floor level and below the bottom surface of the ceiling.

3.2.5 Wiring

Conductors shall be continuous from device to device. Splices shall not be permitted.

Fire alarm system conductors shall be contained in a separate raceway system.

3.2.5.1 Power Source

There shall be one protected phase wire and a solid grounded neutral.

3.2.5.2 Color Codes

Signal-initiating and alarm detector circuit shall have one black loop and one blue loop. Audible signal-sounding circuits wired in series shall have both wires colored red. Audible signal-sounding circuits wired in parallel shall have a red wire for the positive conductors and an orange wire for the negative conductor. Lights, beacons, and indicator circuits shall have brown wires. Each circuit shall maintain the same color code throughout its length.

Fire-alarm-circuit wiring shall be continuous from terminal point to terminal point. Splices shall not be permitted.

3.2.5.3 Installation in Cabinets and Boxes

Wiring in control cabinets and boxes shall be installed with wires properly grouped parallel and perpendicular to the major axis of the building and shall be neatly trained, supported and identified. Control wiring shall be continuous from terminal point to terminal point with no splices. Wires entering or leaving control cabinets and boxes shall be permanently and clearly marked and terminated on screw terminals.

3.3 EXTERNAL SYSTEM WIRING

The following tests shall be performed on the external wiring of the system before connection to the control panel:

Resistance of each zone circuit shall be checked with an ohmmeter. Temporary jumpers shall be inserted in appropriate sockets of missing detectors and the end-of-line resistor shall be installed when this test is performed. Resistance reading for each zone circuit shall be the value of the end-of-line resistor, plus or minus 10 percent.

Resistance of supervised audible-circuit wiring shall be checked with the resistor connected to the last alarm bell in the circuit. Resistance shall be the value of the end-of-line resistor, plus or minus 10 percent.

Each wire shall be checked for grounds with a 500-volt insulation resistance test set. Resistance to ground shall be not less than 20 megohms.

3.3.1 Field Testing

After complete installation of the equipment and at such time as directed by the Contracting Officer, tests shall be conducted to demonstrate that the installation requirements of this specification have been met and that the sequential functions of the system comply with the given requirements. The following tests shall be performed:

Preliminary (Prior to final acceptance): This "in house" test shall verify the systems and components. Preliminary Tests shall be performed as many times as necessary to perform one full test without malfunction.

Final Acceptance: After successful completion of the preliminary testing, the systems be fully tested in the presence of the Contracting Officer and base fire chief or representative for final acceptance.

Contractor shall provide one copy of the test procedures and recording forms for the preliminary tests.

Contractor shall provide 10 copies of the test procedures and recording forms for the final Acceptance Test for approval 30 calendar days prior to system testing.

3.3.2 Fire Alarm System Preliminary Tests

After completion of the above tests, the external wires of the system shall be connected to the appropriate terminals in the control panel and the following tests shall be performed:

Each manual alarm station shall be activated to demonstrate proper operation.

Each product-of-combustion detector shall be activated in accordance with the manufacturer's recommendations to demonstrate proper operation.

One lead on each product-of-combustion detector, manual pull station, HAD, or other input device shall be removed to simulate the trouble condition.

Leads at each alarm-initiating and indicating device shall be removed to verify trouble and then alarm over trouble.

Rate-of-rise function on each HAD in each zone shall be tested by application of heat from heat lamp. HADs shall alarm the system. HADs shall sustain repeated tests of the rate-of-rise function without damage or destruction of the fixed temperature element. HADs reacting to body heat shall be replaced.

Each alarm-initiating circuit shall be demonstrated to operate its associated alarm-control unit.

Each remote reporting device shall be demonstrated to operate in all

modes.

Each alarm-control unit shall be demonstrated to operate in all modes.

Interconnections with fire-protection systems and motor controllers shall be demonstrated to operate as indicated.

3.3.3 Final Fire Alarm System Acceptance Test

After preliminary testing, the Contractor shall perform final system acceptance testing. Testing shall include preliminary functional test and requirements defined in NFPA 72. Testing shall further demonstrate device and equipment functions.

3.3.4 Test Procedures and Test Record Forms

Contractor shall use the following test procedure and test record forms to conduct and record the test.

3.3.4.1 Fire Detection and Alarm System Test Procedure

PRIOR TO TEST, VERIFY THE FOLLOWING:

Contracting Officer and base fire chief have been notified at least 5 calendar days prior to test.

Low voltage wiring continuity and 500 V(dc) insulation resistance tests have been performed.

Record test results on Fire Alarm Test Log.

PRELIMINARY TESTS:

POWER ON - Apply power to fire alarm control panel and verify that "Power On" lamp illuminates. All switches should be in normal position. All other lamps should be off. When other lamps are on, depress reset button for 3 seconds.

LAMP TEST - Depress lamp test button and verify all zone alarm and trouble lamps on. Trouble signal will sound during lamp test.

TROUBLE TEST:

Remove one lead at a time from each alarm initiating and signaling device, including HADs, product-of-combustion detectors, manual stations and flow switches, to simulate trouble condition. Verify trouble lamp comes on for each zone, troubler buzzer, remote report signal at remote reporting device trouble silence, trouble ringback, reset.

ALARM TEST:

Activate each alarm initiating device in accordance with paragraph entitled, "Fire Alarm System Acceptance Test." Coordinate flow switch

activation with water flow test.

For each of the alarm initiating devices, verify the following:

1. Fire alarm speakers sound. (Depress "PUSH TO SILENCE ALARM SIGNALS" pushbutton.)
2. Alarm address is indicated.
3. Alarm signal at remote reporting devices is received.
4. Shut-down of air-handling units

Verify alarm signal over trouble condition for each loop and ground.

GROUND DETECTION TEST:

Connect temporary jumper from ground to each initiating and signal circuit and to each zone circuit conductor at a terminal in panel or at a device.

1. Verify trouble buzzer and trouble lamp are on and verify remote recording.
2. Remove the temporary jumper and verify trouble buzzer is off. Verify lamps off except "POWER ON" lamp.

STANDBY POWER TEST:

Place system on standby power by turning off 120V primary power. Verify trouble indication is on.

Initiate an alarm. Verify fire alarm signals, alarm signal at remote reporting device, and air-handling units shutdown.

Reset system.

Reapply 120V primary power and verify "POWER ON" lamp is on.

With batteries fully charged, turn off 120V primary power. Upon completion of 90 hours of operation on battery, place the system in alarm and verify operation of all alarm devices for 15 minutes, recording battery voltage under no load conditions.

3.3.4.2 Test Record Form

Fire detection system acceptance test report shall be completed after each test. The Contractor shall use the "Inspection and Testing Form" found in NFPA 72 for the test report to be submitted to the Contracting Officer. Acceptance shall be witnessed by the Contractor Officer.

-- End of Section --

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SECTION 13935

WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1015	(1999) Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies
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AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300	(1999) Hypochlorites
AWWA B301	(1999) Liquid Chlorine
AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1998) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm through 1219 mm), for Water
AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151	(2002) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C203	(2002; A C203a-99) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C651	(1999) Disinfecting Water Mains

ASME INTERNATIONAL (ASME)

ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.3	(1998) Malleable Iron Threaded Fittings

ASME B16.4 (1998) Gray Iron Threaded Fittings
ASME B18.2.1 (1996) Square and Hex Bolts and Screws,
Inch Series
ASME B18.2.2 (1987; R 1999) Square and Hex Nuts

ASTM INTERNATIONAL (ASTM)

ASTM A 135 (2001) Electric-Resistance-Welded Steel
Pipe
ASTM A 183 (2003) Carbon Steel Track Bolts and Nuts
ASTM A 47 (1999) Ferritic Malleable Iron Castings
ASTM A 536 (1984; R 1999e1) Ductile Iron Castings
ASTM A 795 (2000) Black and Hot-Dipped Zinc-Coated
(Galvanized) Welded and Seamless Steel
Pipe for Fire Protection Use
ASTM F 436 (2003) Hardened Steel Washers

FM GLOBAL (FM)

FM P7825a (2003) Approval Guide Fire Protection

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13 (2002) Installation of Sprinkler Systems
NFPA 1963 (2003) Fire Hose Connections
NFPA 24 (2002) Installation of Private Fire
Service Mains and Their Appurtenances

UNDERWRITERS LABORATORIES (UL)

UL Fire Prot Dir (2004) Fire Protection Equipment Directory

1.2 GENERAL REQUIREMENTS

Wet pipe sprinkler system shall be provided in all areas of the building as indicated on the drawings. The sprinkler system shall provide fire sprinkler protection for the entire area. Except as modified herein, the system shall be designed and installed in accordance with NFPA 13. Pipe sizes which are not indicated on drawings shall be determined by hydraulic calculation. The Contractor shall design any portions of the sprinkler system that are not indicated on the drawings including locating sprinklers, piping and equipment, and size piping and equipment when this information is not indicated on the drawings or is not specified herein. The design of the sprinkler system shall be based on hydraulic

calculations, and the other provisions specified herein.

1.2.1 Hydraulic Design

The system shall be hydraulically designed to discharge a minimum density of 8.15 L/min per square meter (.20 gpm per square foot) over the hydraulically most demanding 280 square meters (3,000 square feet) of floor area. Hydraulic calculations shall be in accordance with the Area/Density Method of NFPA 13.

1.2.1.1 Hose Demand

An allowance for exterior hose streams of 1892 L/min (500 gpm) shall be added to the sprinkler system demand at the point of connection to the existing system.

1.2.1.2 Basis for Calculations

The design of the system shall be based upon a water supply with a static pressure of 345 kPa (50 psi), and a flow of 3755 L/min (992 gpm) at a residual pressure of 331 kPa (48 psi). Water supply shall be presumed available at the point of connection to existing. Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping, 140 for cement-lined ductile-iron piping.

1.2.2 Sprinkler Coverage

Sprinklers shall be uniformly spaced on branch lines. In buildings protected by automatic sprinklers, sprinklers shall provide coverage throughout 100 percent of the building. This includes, but is not limited to, telephone rooms, electrical equipment rooms, boiler rooms, switchgear rooms, transformer rooms, and other electrical and mechanical spaces. Coverage per sprinkler shall be in accordance with NFPA 13, but shall not exceed 9 square m 100 square feet for extra hazard occupancies, 12 square m (130 square feet) for ordinary hazard occupancies, and 21 square m (225 square feet) for light hazard occupancies.

1.3 COORDINATION OF TRADES

Piping offsets, fittings, and any other accessories required shall be furnished as required to provide a complete installation and to eliminate interference with other construction. Sprinkler shall be installed over and under ducts, piping and platforms when such equipment can negatively effect or disrupt the sprinkler discharge pattern and coverage.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be housed in a manner to preclude any damage from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify

all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings; G

Three copies of the Sprinkler System Shop Drawings, no later than 21 days prior to the start of sprinkler system installation.

As-Built Drawings

As-built shop drawings, at least 14 days after completion of the Final Tests. The Sprinkler System Drawings shall be updated to reflect as-built conditions after all related work is completed and shall be on reproducible full-size mylar film.

SD-03 Product Data

Sway Bracing; G

For systems that are required to be protected against damage from earthquakes, load calculations shall be provided for sizing of sway bracing.

Materials and Equipment; G

Manufacturer's catalog data included with the Sprinkler System Drawings for all items specified herein. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with all contract requirements. In addition, a complete equipment list that includes equipment description, model number and quantity shall be provided.

Hydraulic Calculations; G

Hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments.

Spare Parts

Spare parts data shall be included for each different item of material and equipment specified.

Preliminary Tests; G

Proposed procedures for Preliminary Tests, no later than 14 days prior to the proposed start of the tests. Proposed date and time to begin the preliminary tests.

Final Acceptance Test; G

Proposed procedures for Final Acceptance Test, no later than 14 days prior to the proposed start of the tests. Proposed date and time to begin Final Acceptance Test, submitted with the Final Acceptance Test Procedures. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.

On-site Training; G

Proposed On-site Training schedule, at least 14 days prior to the start of related training.

Fire Protection Specialist; G

The name and documentation of certification of the proposed Fire Protection Specialists, no later than 14 days after the Notice to Proceed and prior to the submittal of the sprinkler system drawings and hydraulic calculations.

Sprinkler System Installer; G

The name and documentation of certification of the proposed Sprinkler System Installer, concurrent with submittal of the Fire Protection Specialist Qualifications.

SD-06 Test Reports

Preliminary Test Report; G

Three copies of the completed Preliminary Test Report, no later than 7 days after the completion of the Preliminary Tests. The Preliminary Tests Report shall include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping. All items in the Preliminary Tests Report shall be signed by the Fire Protection Specialist.

Final Acceptance Test Report; G

Three copies of the completed Final Acceptance Tests Reports, no later than 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed by the Fire Protection Specialist.

SD-07 Certificates

Inspection by Fire Protection Specialist; G

Concurrent with the Final Acceptance Test Report, certification by the Fire Protection Specialist that the sprinkler system is installed in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports.

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 14 days prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment.

1.7 HYDRAULIC CALCULATIONS

Hydraulic calculations shall be as outlined in NFPA 13 except that calculations shall be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings. Software that uses k-factors for typical branch lines is not acceptable. Calculations shall be based on the water supply data shown on the drawings. Calculations shall substantiate that the design area used in the calculations is the most demanding hydraulically. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used.

1.8 FIRE PROTECTION SPECIALIST

Work specified in this section shall be performed under the supervision of and certified by the Fire Protection Specialist. The Fire Protection Specialist shall be an individual who is a registered professional fire protection engineer. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.9 SPRINKLER SYSTEM INSTALLER

Work specified in this section shall be performed by the Sprinkler System Installer. The Sprinkler System Installer shall be regularly engaged in the installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.10 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

1.11 SPARE PARTS

The Contractor shall submit spare parts data for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

1.12 SHOP DRAWINGS

The Sprinkler System Shop Drawings shall conform to the requirements established for working plans as prescribed in NFPA 13. Drawings shall include plan and elevation views demonstrating that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

- a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.
- b. Floor plans drawn to a scale not less than 1:100 (1/8" = 1'-0") which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.
- c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall show the dimension from the sprinkler and

sprinkler deflector to the ceiling in finished areas.

d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.

e. Details of each type of riser assembly; pipe hanger; sway bracing for earthquake protection, and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

Materials and Equipment shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a.

2.4 UNDERGROUND PIPING COMPONENTS

2.4.1 Pipe

Piping from a point 150 mm (6 inches) above the floor to a point 1500 mm (5 feet) outside the building wall shall be ductile iron with a rated working pressure of 1207 kPa (175 psi) conforming to AWWA C151, with cement mortar lining conforming to AWWA C104. Piping more than 1500 mm (5 feet) outside the building walls shall comply with Section 02510A WATER DISTRIBUTION SYSTEM.

2.4.2 Fittings and Gaskets

Fittings shall be ductile iron conforming to AWWA C110. Gaskets shall be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile iron pipe joints shall conform to AWWA C111.

2.5 ABOVEGROUND PIPING COMPONENTS

Aboveground piping shall be steel.

2.5.1 Steel Piping Components

2.5.1.1 Steel Pipe

Except as modified herein, steel pipe shall be black galvanized where indicated as permitted by NFPA 13 and shall conform to applicable provisions of ASTM A 795 or ASTM A 135. Pipe in which threads or grooves are cut shall be Schedule 40 or shall be listed by Underwriters' Laboratories to have a corrosion resistance ratio (CRR) of 1.0 or greater after threads or grooves are cut. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

2.5.1.2 Fittings for Non-Grooved Steel Pipe

Fittings shall be cast iron conforming to ASME B16.4, or malleable iron conforming to ASME B16.3. Galvanized fittings shall be used for piping systems or portions of piping systems utilizing galvanized piping. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

2.5.1.3 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 1200 kPa (175 psi) service and shall be the product of the same manufacturer; segmented welded fittings shall not be used. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

2.5.1.4 Flanges

Flanges shall conform to NFPA 13 and ASME B16.1. Grooved flanges are acceptable. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1.6 mm (1/16 inch) thick, and full face or self-centering flat ring type.

2.5.1.5 Bolts, Nut, and Washers

Bolts shall be hexhead conforming to ASME B18.2.1. Nuts shall be hexagon type conforming to ASME B18.2.2. Washers shall meet the requirements of ASTM F 436.

2.5.2 Pipe Hangers

Hangers shall be listed in UL Fire Prot Dir or FM P7825a and of the type suitable for the application, construction, and pipe type and sized to be supported.

2.5.3 Valves

2.5.3.1 Control Valve and Gate Valve

Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) type and shall be listed in UL Bld Mat Dir or FM P7825a.

2.5.3.2 Check Valve

Check valve 50 mm (2 inches) and larger shall be listed in UL Bld Mat Dir or FM P7825a. Check valves 100 mm (4 inches) and larger shall be of the swing type with flanged or grooved cast iron body.

2.6 WATERFLOW ALARM

Electrically operated, exterior-mounted, waterflow alarm horn/strobe shall be provided and installed in accordance with NFPA 13. Waterflow alarm bell shall be rated 24 VDC and shall be connected to the Fire Alarm Control Panel(FACP) in accordance with Section 13851 FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE.

2.7 ALARM INITIATING AND SUPERVISORY DEVICES

2.7.1 Sprinkler Waterflow Indicator Switch, Vane Type

Switch shall be vane type with a pipe saddle and cast aluminum housing. The electro-mechanical device shall include a flexible, low-density polyethylene paddle conforming to the inside diameter of the fire protection pipe. The device shall sense water movements and be capable of detecting a sustained flow of 38 L/min (10 gpm) or greater. The device shall contain a retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. The switch shall be tamper resistant and contain two SPDT (Form C) contacts arranged to transfer upon removal of the housing cover, and shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture.

2.7.2 Valve Supervisory (Tamper) Switch

Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

2.8 FIRE DEPARTMENT CONNECTION

Fire department connection shall be projecting type with cast brass body, matching wall escutcheon lettered "Auto Spkr" with a polished brass finish.

The connection shall have two inlets with individual self-closing clappers, caps with drip drains and chains. Female inlets shall have (2-1/2 inch) diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963.

2.9 SPRINKLERS

Sprinklers shall be used in accordance with their listed coverage limitations. Temperature classification shall be as required. Sprinklers in high heat areas including attic spaces or in close proximity to unit

heaters shall have temperature classification in accordance with NFPA 13. Extended coverage sprinklers shall not be used.

2.9.1 Recessed Sprinkler

Recessed sprinkler shall be white polyester, glass bulb, quick-response type and shall have a nominal 12.7 mm (1/2 inch) or 13.5 mm (17/32 inch) orifice.

2.9.2 Pendent Sprinkler

Pendent sprinkler shall be of the glass bulb, quick-response type with nominal 12.7 mm (1/2 inch) or 13.5 mm (17/32 inch) orifice. Pendent sprinklers shall have a white polyester finish.

2.9.3 Upright Sprinkler

Upright sprinkler shall be brass, glass bulb, quick-response type and shall have a nominal 12.7 mm (1/2 inch) or 13.5 mm (17/32 inch) orifice.

2.9.4 Sidewall Sprinkler

Sidewall sprinkler shall have a nominal 12.7 mm (1/2 inch) orifice. Sidewall sprinkler shall have a brass finish. Sidewall sprinkler shall be the glass bulb, quick-response type.

2.10 DISINFECTING MATERIALS

2.10.1 Liquid Chlorine

Liquid chlorine shall conform to AWWA B301.

2.10.2 Hypochlorites

Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

2.11 ACCESSORIES

2.11.1 Sprinkler Cabinet

Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

2.11.2 Pendent Sprinkler Recessed Escutcheon

Escutcheon shall be two-piece metallic type and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

2.11.3 Pipe Escutcheon

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.

2.11.4 Identification Sign

Valve identification sign shall be minimum 150 mm wide x 50 mm high (6 inches wide x 2 inches high) with enamel baked finish on minimum 1.214 mm (18 gauge) steel or 0.6 mm (0.024 inch) aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain," "auxiliary drain," "inspector's test," "alarm test," "alarm line," and similar wording as required to identify operational components.

2.12 DOUBLE-CHECK VALVE BACKFLOW PREVENTION ASSEMBLY

Double-check backflow prevention assembly shall comply with ASSE 1015. The assembly shall have a bronze, cast-iron or stainless steel body with flanged or grooved ends. The assembly shall include pressure gauge test ports and OS&Y shutoff valves on the inlet and outlet, 2-positive-seating check valve for continuous pressure application, and four test cocks. Assemblies shall be rated for working pressure of 1207 kPa (175 psi). The maximum pressure loss shall be 40 kPa (6 psi) at a flow rate equal to the sprinkler water demand, at the location of the assembly. A test port for a pressure gauge shall be provided both upstream and downstream of the double check backflow prevention assembly valves.

PART 3 EXECUTION

3.1 FIRE PROTECTION RELATED SUBMITTALS

The Fire Protection Specialist shall prepare submittals from the Contract Submittal Register that relate to the successful installation of the sprinkler systems. The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government.

3.2 INSTALLATION REQUIREMENTS

The installation shall be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein.

3.3 INSPECTION BY FIRE PROTECTION SPECIALIST

The Fire Protection Specialist shall inspect the sprinkler system periodically during the installation to assure that the sprinkler system is being provided and installed in accordance with the contract requirements. The Fire Protection Specialist shall witness the preliminary and final tests, and shall sign the test results. The Fire Protection Specialist, after completion of the system inspections and a successful final test, shall certify in writing that the system has been installed in accordance with the contract requirements. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered.

3.4 ABOVEGROUND PIPING INSTALLATION

3.4.1 Protection of Piping Against Earthquake Damage

The system piping shall be protected against damage from earthquakes. Seismic protection shall include flexible and rigid couplings, sway bracing, seismic separation assemblies where piping crosses building seismic separation joints, and other features as required by NFPA 13 for protection of piping against damage from earthquakes.

3.4.2 Piping in Exposed Areas

Exposed piping shall be installed so as not to diminish exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

3.4.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

3.4.4 Pendent Sprinklers

Drop nipples to pendent sprinklers shall consist of minimum 25 mm (1 inch) pipe with a reducing coupling into which the sprinkler shall be threaded. Hangers shall be provided on arm-overs to drop nipples supplying pendent sprinklers when the arm-over exceeds 300 mm (24 inches). Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 100 mm (4 inches). Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling shall not exceed the manufacturer's listed range and shall be of uniform depth throughout the finished area.

3.4.4.1 Pendent Sprinkler Locations

Pendent sprinklers in suspended ceilings shall be a minimum of 150 mm (6 inches) from ceiling grid.

3.4.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 750 mm (30 inches) in length shall be individually supported.

3.4.6 Pipe Joints

Pipe joints shall conform to NFPA 13, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site.

Flanged joints shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings, fittings and grooving tools shall be products of the same manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances.

3.4.7 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings or grooved-end or rubber-gasketed reducing couplings. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 15 mm (1/2 inch).

3.4.8 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled. Holes shall provide required clearance between the pipe and the hole wall per NFPA 13. The space between the hole and the pipe shall be firmly packed with mineral wool insulation. Where pipes penetrate fire walls, fire partitions, or floors, pipes shall be fire stopped in accordance with Section 07840 FIRESTOPPING. In penetrations that are not fire-rated or not a floor penetration, the space between the hole and the pipe shall be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

3.4.9 Escutcheons

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

3.4.10 Inspector's Test Connection

Unless otherwise indicated, test connection shall consist of 25 mm (1 inch) pipe connected at the riser as a combination test and drain valve; a test valve located approximately 1.8 meters (6 feet) above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with

the words "Inspector's Test." The discharge orifice shall be located outside the building wall directed so as not to cause damage to adjacent construction or landscaping during full flow discharge.

3.4.11 Drains

Main drain piping shall be provided to discharge at a safe point outside the building. Auxiliary drains shall be provided as required by NFPA 13. All drain piping shall be galvanized.

3.4.12 Installation of Fire Department Connection

Connection shall be mounted on the exterior wall approximately 900 mm 3 feet above finished grade. The piping between the connection and the check valve shall be galvanized provided with an automatic drip in accordance with NFPA 13 and arranged to drain to the outside.

3.4.13 Identification Signs

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

3.5 UNDERGROUND PIPING INSTALLATION

The fire protection water main shall be laid, and joints anchored, in accordance with NFPA 24. Minimum depth of cover shall be 1,828 mm (6 feet).

The supply line shall terminate inside the building with a flanged piece, the bottom of which shall be set not less than 150 mm (6 inches) above the finished floor. A blind flange shall be installed temporarily on top of the flanged piece to prevent the entrance of foreign matter into the supply line. A concrete thrust block shall be provided at the elbow where the pipe turns up toward the floor. In addition, joints shall be anchored in accordance with NFPA 24 using pipe clamps and steel rods from the elbow to the flange above the floor and from the elbow to a pipe clamp in the horizontal run of pipe. Buried steel components shall be provided with a corrosion protective coating in accordance with AWWA C203. Piping more than 1500 mm (5 feet) outside the building walls shall meet the requirements of Section 02510A WATER DISTRIBUTION SYSTEM.

3.6 EARTHWORK

Earthwork shall be performed in accordance with applicable provisions of Section 02300 EARTHWORK.

3.7 ELECTRICAL WORK

Alarm signal wiring connected to the building fire alarm control system shall be in accordance with Section 13851 FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE.

3.8 DISINFECTION

After all system components are installed and hydrostatic test(s) are successfully completed, each portion of the sprinkler system to be disinfected shall be thoroughly flushed with potable water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material. Flushing shall be conducted by removing the flushing fitting of the cross mains and of the grid branch lines, and then back-flushing through the sprinkler main drains. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652. The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump shall be used. Chlorination application shall continue until the entire system is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. The system shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in disinfected containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA EWW. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained. After successful completion, verify installation of all sprinklers and plugs and pressure test the system.

3.9 PIPE COLOR CODE MARKING

Color code marking of piping shall be as specified in Section 09900 PAINTS AND COATINGS.

3.10 PRELIMINARY TESTS

The system, including the underground water mains, and the aboveground piping and system components, shall be tested to assure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with NFPA 13 and NFPA 24. Upon completion of specified tests, the Contractor shall complete certificates as specified in paragraph SUBMITTALS.

3.10.1 Underground Piping

3.10.1.1 Flushing

Underground piping shall be flushed in accordance with NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less than the calculated maximum water

demand rate of the system.

3.10.1.2 Hydrostatic Testing

New underground piping shall be hydrostatically tested in accordance with NFPA 24. The allowable leakage shall be measured at the specified test pressure by pumping from a calibrated container. The amount of leakage at the joints shall not exceed 1.89 liters (2 quarts) per hour per 100 gaskets or joints, regardless of pipe diameter.

3.10.2 Aboveground Piping

3.10.2.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 1400 kPa (200 psi) and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

3.10.2.2 Backflow Prevention Assembly Forward Flow Test

Each backflow prevention assembly shall be tested at system flow demand, including all applicable hose streams, as specified in NFPA 13. The Contractor shall provide all equipment and instruments necessary to conduct a complete forward flow test, including 65 mm (2-1/2 inch) hoses, playpipe nozzles, calibrated pressure gauges, and pitot tube gauge. The Contractor shall provide all necessary supports to safely secure hoses and nozzles during the test. At the system demand flow, the pressure readings and pressure drop (friction) across the assembly shall be recorded. A metal placard shall be provided on the backflow prevention assembly that lists the pressure readings both upstream and downstream of the assembly, total pressure drop, and the system test flow rate. The pressure drop shall be compared to the manufacturer's data.

3.10.3 Testing of Alarm Devices

Each alarm switch shall be tested by flowing water through the inspector's test connection. Each water-operated alarm devices shall be tested to verify proper operation.

3.10.4 Main Drain Flow Test

Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

3.11 FINAL ACCEPTANCE TEST

Final Acceptance Test shall begin only when the Preliminary Test Report has been approved. The Fire Protection Specialist shall conduct the Final

Acceptance Test and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. In addition, the representative shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received. The Contractor shall submit the Final Acceptance Test Report as specified in the Submittals paragraph.

3.12 ON-SITE TRAINING

The Fire Protection Specialist shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of two hours of normal working time for both A and B shifts and shall start after the system is functionally complete and after the Final Acceptance Test. The On-Site Training shall cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

SECTION 13965

DRY CHEMICAL FIRE EXTINGUISHING SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

FM GLOBAL (FM)

FM P7825a (2003) Approval Guide Fire Protection

FM P7825b (2003) Approval Guide Electrical Equipment

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 96 (2001) Ventilation Control and Fire
Protection of Commercial Cooking Operations

UNDERWRITERS LABORATORIES (UL)

UL Fire Prot Dir (2004) Fire Protection Equipment Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Dry Chemical Fire Extinguishing System; G

Drawings consisting of system layout including assembly and installation details and electrical connection diagrams; piping layout showing pipe sizes, lengths, and supports. Drawings shall include any information required to demonstrate that the system has been coordinated and will function as intended and shall show system relationship to items it protects and clearances required for operation and maintenance. Drawings shall also include conduit, cables, manual actuation stations and fusible links.

SD-03 Product Data

Similar Services

A statement of qualifications as specified.

Dry Chemical Fire Extinguishing System; G

Manufacturer's catalog data including detail drawings for the following items. The data shall be highlighted to show model, size, options, etc., that are intended for consideration and shall be adequate to demonstrate compliance with contract requirements.

- a. Storage containers and mounting brackets
- b. Fusible links, cables, conduit, corner pulleys, and link mounting frames/brackets
- c. Release mechanisms
- d. Valves
- e. Discharge nozzles
- f. Piping components
- g. Remote manual actuation stations
- h. Fuel and power shutoff
- i. Alarms, alarm devices, alarm interface(s), control panels

Preliminary Tests; G

Proposed test procedures for preliminary test, at least 2 weeks before the start of related testing. System diagrams that show system layout and typed condensed normal and emergency operating procedures, methods for checking the system for normal, safe operation, and procedures for manual actuation shall be framed under glass or laminated plastic. After approval, these items shall be posted where directed.

Final Acceptance Tests; G

Proposed test procedures for final acceptance test, at least 2 weeks before the start of related testing. Proposed test schedule for acceptance test, at least 2 weeks before the start of related testing.

Field Training

Proposed schedule for field training, at least 2 weeks before the start of related training.

SD-06 Test Reports

Preliminary Tests

Test report for the preliminary tests in booklet form, upon

completion of testing. Report shall document test results including repairs and adjustments made, and final test results.

Final Acceptance Tests

Test report for the final acceptance tests in booklet form, upon completion of testing. Report shall document test results including repairs and adjustments made, and final test results. The weight of each storage container shall be recorded before final acceptance test and after test has been completed and containers recharged.

SD-07 Certificates

Installation Technician; G

Concurrent with statement of similar services, manufacturer's certification of installation technician.

Installation Drawings; G

Concurrent with installation drawings, manufacturer's certification of installation drawings.

SD-10 Operation and Maintenance Data

Dry Chemical Fire Extinguishing System

Six manuals listing step-by-step procedures required for system actuation (automatic and manual), recharging, and routine maintenance, at least 2 weeks before field training. The manuals shall include the manufacturer's name, model number, parts list, list of tools and parts that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and control diagrams, troubleshooting guide, and recommended service organization (including address and telephone number).

1.3 GENERAL REQUIREMENTS

1.3.1 System Description

The paint booth and exhaust duct serving the paint booth shall be protected by preengineered dry chemical fire extinguishing system. System shall be installed with all accessories necessary for system to operate in accordance with manufacturer's instructions and as specified herein.

1.3.2 Regulatory Requirements

System application, design, and installation shall comply with NFPA 17A and NFPA 96, except as follows:

- a. Compliance shall include conformance to the advisory provisions by changing "should" to "shall."

- b. System components shall be listed in UL Fire Prot Dir or approved by FM P7825a and FM P7825b for use with dry chemical fire extinguishing systems.
- c. Reference to the "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

1.3.3 Installation Drawings

Installation drawings shall be prepared by a representative of the manufacturer to ensure compliance with the requirements listed herein and with all manufacturer's requirements and recommendations.

1.3.4 Installation Technician

The installation technician shall have been trained by the system manufacturer for system installation, operation, and maintenance.

1.3.5 Similar Services

The Contractor shall submit a statement demonstrating successful completion of similar services on at least five projects of similar size and scope, at least 2 weeks before submittal of other items required by this section.

1.4 COORDINATION OF TRADES

Each system shall be coordinated with the equipment and exhaust ducts that it protects along with other construction in order to eliminate any interference.

1.5 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

System components shall be the standard products of a manufacturer regularly engaged in the manufacturing of products that are of similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years before bid opening. The 2-year experience shall include installations of systems under similar circumstances and of similar size. Systems shall be supported by a service organization.

2.2 PIPING COMPONENTS

2.2.1 Pipe and Fittings

Pipe and fittings shall be Schedule 40 black steel.

2.2.2 Nozzles

Nozzles shall be stainless steel and shall be equipped with an integral strainer to prevent matter inside the distribution piping from clogging the nozzle orifice. Each nozzle orifice shall be provided with a seal to protect the nozzle from clogging by paint or other obstructions. This seal shall detach upon actuation.

2.3 SYSTEM CONTROLS

Each system shall be actuated by fusible link and by a remote manual actuation station connected to the extinguishing system release mechanism by cable. Remote manual actuation stations shall be located along the path of egress and shall automatically actuate the building fire alarm system. The system controls shall automatically shut off fuel flow and electrical power to the protected appliances and other appliances located under the ventilating system protected by the extinguishing system upon system actuation. All cables used shall be stainless steel with corner pulleys employing stainless steel ball bearings at all corners. All cable and wiring shall be enclosed in conduit.

2.4 DRY CHEMICAL

The dry chemical shall not have an adverse effect on black steel during exposure periods of up to 24 hours.

2.5 IDENTIFICATION SIGNS

Identification signs shall be located at each remote manual actuation station. Signs shall be fabricated of rigid plastic, red in color, with engraved white letters that are a minimum 6.5 mm (0.25 inches) in height. Each sign shall be engraved with "Fire Extinguishing System" and with a brief description of the equipment protected.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be performed by the installation technician in accordance with system manufacturer's instructions. Ductwork access doors shall be provided where indicated and at any items requiring service and inspection, including nozzles and fusible links. Ductwork access doors shall be in accordance with Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

3.2 PRELIMINARY TESTS

After installation has been completed, each system shall be actuated by both fusible link and by remote actuation station to demonstrate proper function of all components, including alarms, fuel flow and power shut off.

Actuation by fusible link shall be in a manner approved by the system manufacturer. Test containers, pressurized with either nitrogen or air to normal system operating pressure and of the same size as actual operating

containers shall be discharged into system. The seals shall release as during normal actuation. After each discharge, the nozzles shall be removed, disassembled, and strainers shall be cleaned. System piping shall be inspected and cleaned as necessary. All functions of system operation shall be verified, including switches, shutdown of fuel and power to appliances protected by the system or served by the same ventilation system, uniform delivery of air or nitrogen, and activation of alarms. Nozzle seals/covers shall be replaced after the preliminary tests are complete. In the event portions of the tests are unsuccessful, repairs shall be made and the entire test repeated until successful.

3.3 FINAL ACCEPTANCE TESTS

System shall be actuated by both fusible link and remote manual actuation station and all system functions shall be verified as described in Paragraph PRELIMINARY TESTS using test containers specified for preliminary tests. All tests or checks recommended by the manufacturer shall also be performed. In the event portions of the tests are unsuccessful, repairs shall be made and the entire test repeated until successful. Nozzle seals/covers shall be replaced after the final acceptance tests are complete. The system shall be returned to normal operating condition after the completion of testing. Extinguishing system and equipment shall be cleaned after completion of testing. Any damage shall be repaired by the Contractor. The weight of each storage container shall be recorded before final acceptance test and after test has been completed and containers recharged.

3.4 FIELD TRAINING

The Contractor shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of two hours of normal working time for both A and B shifts and shall start after the system is functionally complete and after the Final Acceptance Test. The field instruction shall cover all of the items contained in the approved Operation and Maintenance Instructions.

-- End of Section --

SECTION 15003

GENERAL MECHANICAL PROVISIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A13.1 (1996) Scheme for the Identification of Piping Systems

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M (2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM B 766 (2003) Standard Specification for Electrodeposited Coatings of Cadmium

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1650 (1998) Seismic Restraint Manual: Guidelines for Mechanical Systems

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 82 (1996) Protection of Stratospheric Ozone

UNDERWRITERS LABORATORIES (UL)

UL 6 (2003) UL Standard for Safety for Electrical Rigid Metal Conduit-Steel

UL Bld Mat Dir (2003) Building Materials Directory

1.2 SUBMITTALS

Not Used

1.3 COORDINATION

Contractor shall coordinate the work of the different trades so that interference between piping, equipment, structural, and electrical work will be avoided. All necessary offsets in piping and ductwork, and all fittings, and other components, required to install the work properly shall be furnished complete in place at no additional cost to the Government.

1.4 MECHANICAL SYSTEMS IDENTIFICATION

1.4.1 Diagrams

Chart listing of equipment shall be by designation numbers and capacities such as flow rates, pressure and temperature differences, heating and cooling capacities, horsepower, pipe sizes, and voltage and current characteristics. This requirement shall not apply for accessories or minor equipment items, such as vents, but is required for such equipment as pumps, water heaters, air-handling system equipment, refrigeration compressors, heat exchangers, and boilers.

Diagrams shall be neat mechanical drawings provided with extruded aluminum frames and 1/8-inch acrylic plastic protection. Location shall be as directed by the Contracting Officer. The number of charts and diagrams shall be equal to or greater than the number of mechanical equipment rooms.

Where more than one chart per space is required, these shall be mounted in edge pivoted, swinging leaf, extruded aluminum frame holders which open to 170 degrees.

1.4.2 Identification Tags

Identification tags made of brass or aluminum indicating function of a control or similar component shall be installed on such system devices. Tags shall be 2 inches in diameter and marking shall be stamped.

Equipment shall be provided with metal identification tags displaying an equipment designation number matching drawing or control diagram designation.

Tags shall be wired to valve or equipment items with No. 12 AWG 0.0808-inch diameter corrosion-resistant steel wire.

1.4.3 Pipe Identification

Pipes in exposed areas and in accessible pipe spaces shall be identified with color bands, titles, and direction of flow arrows. These color bands, titles, and direction of flow arrows shall be applied in the following locations; Adjacent to all valves (except those provided at plumbing fixtures), at straight pipe runs in intervals not exceeding 40 feet, adjacent to all changes in pipe direction, and on both sides where pipes pass through walls or floors. Pipe markings (Labels) shall be provided using approved pressure sensitive adhesive labels in the colors listed in TABLE I and in sizes listed in TABLE II. Color-coded direction of flow arrows shall be provided using pressure sensitive adhesive bands 360 degrees around the pipe. Labels and markers shall be of a standard manufacture. Painting of piping shall be as indicated in section 09900 for insulated and un-insulated piping. The color for painted piping shall be as indicated in the "Band" column in Table I below. Legends shall be printed in upper-case letters as listed in TABLE I and installed as framed instructions in each mechanical room or mechanical space.

TABLE I. COLOR CODES FOR MARKING PIPE

Material	Band	Letters and Arrow*	Legend
Cold water (potable)	Green	White	POTABLE WATER
Fire protection water	Red	White	FIRE PR. WATER
Fire Sprinkler Water	Red	White	FIRE SPR. WATER
Hot water (domestic)	Green	White	H.W.
Hot water re-circulating (domestic)	Green	White	H.W.R.
High temp. water supply	Yellow	Black	H.T.W.S.
High temp. water return	Yellow	Black	H.T.W.R.
Boiler feed water	Yellow	Black	B.F.
Low temp. water supply (heating)	Yellow	Black	L.T.W.S.
Low temp. water return (heating)	Yellow	Black	L.T.W.R.
Condenser water supply	Green	White	COND. W.S.
Condenser water return	Green	White	COND. W.R.
Chilled water supply, Glycol	Yellow	Black	C.H.W.S.
Chilled water return, Glycol	Yellow	Black	C.H.W.R.
Treated water	Green	White	TR. WATER
Chemical feed	Yellow	Black	CH. FEED
Compressed air	Blue	White	COMP. AIR
Natural gas	Yellow	Black	NAT. GAS
Propane Gas	Yellow	Black	PROP. GAS
Refrigerants	Blue	White	REFRIGERANT
Fuel oil	Yellow	Black	FUEL OIL
Steam	Yellow	Black	STEAM
Condensate	Yellow	Black	CONDENSATE
Hydraulic fluid under 600 psi	Green	White	HYDRAULIC
FUID -____PSI			
Hydraulic fluid 600 psi and Greater	Yellow	Black	HYDRAULIC
FLUID-____PSI			

TABLE II. COLOR CODE MARKING SIZES

Outside Diameter of Pipe Covering (Inches)	Length of Color Band (Inches)	Arrow Length x Width (Inches)	Size of Legend Letters & Numerals (Inches)
Less than 1-1/2	8	8 x 2-1/4	1/2
1-1/2 to 2-3/8	8	8 x 2-1/4	3/4
2-1/2 to 7-7/8	12	8 x 2-1/4	1-1/4
8 to 10	24	12 x 4-1/2	2-1/2
Over 10	32	12 x 4-1/2	3-1/2

Similar services with different temperatures or pressures shall be identified. Where pressures may exceed 125 pounds per square inch, gage, the maximum system pressure shall be included in the label.

Piping shall be labeled and arrowed in accordance with the following:

Each point of entry and exit of pipe passing through walls

Each change in direction, i.e., elbows, tees

In congested or hidden areas and at all access panels at each point required to clarify service or indicated hazard.

In long straight runs, labels shall be located at distances within eyesight of each other but in no case shall the distance between labels exceed 75 feet. All labels shall be visible and legible from the primary service and operating area.

<u>For Bare or Insulated Pipes for Outside Diameters of</u>	<u>Lettering</u>
1/2 thru 1-3/8 inch	1/2 inch
1-1/2 thru 2-3/8 inch	3/4 inch
2-1/2 inch and larger	1-1/4 inch

Labels shall be made of self-sticking, plastic film designed for permanent installation.

1.5 COLOR CODING

Color coding of all piping systems shall be in accordance with ANSI A13.1.

1.6 APPROVAL REQUIREMENTS

Except as otherwise specified, approval of materials and equipment will be based on manufacturer's published data.

Where materials and equipment are specified to conform to the standards of the Underwriters Laboratories, the label of or listing with reexamination in UL Bld Mat Dir, and UL 6 will be acceptable as sufficient evidence that the items conform to Underwriters Laboratories requirements. In lieu of such label or listing, the Contractor may submit a written certificate from any nationally recognized testing agency, adequately equipped and competent to perform such services, stating that the items have been tested and that the units conform to the specified requirements. Methods of testing used by the specified agencies shall be outlined.

Where materials or equipment are specified to be constructed or tested, or both, in accordance with the standards of the ASTM International (ASTM), the ASME International (ASME), or other standards, a manufacturer's certificate of compliance of each item will be acceptable as proof of compliance.

Conformance to such agency requirements does not relieve the item from compliance with other requirements of these specifications.

1.7 PREVENTION OF CORROSION

Metallic materials shall be protected against corrosion. Equipment enclosures shall be given rust-inhibiting treatment and standard finish by the manufacturer. Aluminum shall not be used in contact with earth, and where connected to dissimilar metal, shall be protected by approved fittings, barrier material, or treatment. Ferrous parts such as anchors,

bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of corrosion-resistant steel or nonferrous materials shall be hot-dip galvanized in accordance with ASTM A 123/A 123M for exterior locations and cadmium-plated in conformance with ASTM B 766 for interior locations.

1.8 OZONE DEPLETING SUBSTANCES USED AS REFRIGERANTS

Releases of Ozone Depleting Substances (ODS) during repair, maintenance, servicing or disposal of appliances containing ODS's will be minimized by complying with all applicable sections of 40 CFR 82 Part 82 Subpart F. Any person conducting repair, maintenance, servicing or disposal of appliances owned by NASA comply with the following:

No Class I or Class II substances used as a refrigerant may be knowingly vented or otherwise released into the environment.

No appliances may be opened without meeting the requirements of 40 CFR 82 Part 82.156 Subpart F, regarding required practices regarding evacuation and collection of refrigerant, and 40 CFR 82 Part 82.158 Subpart F, regarding standards of recycling and recovery equipment.

No work may be conducted on appliances containing refrigerant except by persons who comply with 40 CFR 82 Part 82.161 Subpart F, regarding technician certification.

In addition, copies of all applicable certifications must be provided to the Contracting Officer at least 14 calendar days prior to initiating maintenance, repair, servicing, dismantling or disposal of appliances, including:

Proof of Technician Certification

Proof of Equipment Certification, if recovery or recycling equipment is to be provided by the Contractor

Proof of availability of certified recovery or recycling equipment, if equipment is to be provided by the Contractor

1.9 USE OF OZONE DEPLETING SUBSTANCES, OTHER THAN REFRIGERANTS

The use of Class I or Class II ODS's listed as nonessential in 40 CFR 82 Part 82.66 Subpart C is prohibited. These prohibited materials and uses include:

Any plastic party spray streamer or noise horn which is propelled by a chlorofluorocarbon

Any cleaning fluid for electronic and photographic equipment which contains a chlorofluorocarbon; including liquid packaging, solvent wipes, solvent sprays, and gas sprays

Any plastic flexible or packaging foam product which is manufactured with or contains a chlorofluorocarbon, including, open cell foam, open

cell rigid polyurethane poured foam, closed cell extruded polystyrene sheet foam, closed cell polyethylene foam and closed cell polypropylene foam except for flexible or packaging foam used in coaxial

Any aerosol product or other pressurized dispenser which contains a chlorofluorocarbon, except for those listed in 40 CFR 82 Part 82.66 Subpart C.

A waiver may be requested should a programmatic or facility requirement dictate that a prohibited material is necessary to achieve project goals. A waiver request must be submitted in writing to the Contracting Officer. The waiver will be evaluated and dispositioned.

PART 2 PRODUCTS

2.1 IDENTIFICATION PLATES

In addition to standard manufacturer's identification plates, engraved laminated phenolic identification plates shall be provided for each piece of mechanical equipment. Identification plates shall designate the function of the equipment. Designation shall be submitted with the shop drawings.

Identification plates shall be three layers, black-white-black, engraved to show white letters on black background. Letters shall be upper case. Identification plates 1-1/2-inches high and smaller shall be 1/16-inch thick, with engraved lettering 1/8-inch high; identification plates larger than 1-1/2-inches high shall be 1/8-inch thick, with engraved lettering of suitable height. Identification plates 1-1/2-inches high and larger shall have beveled edges. Identification plates shall be installed using a compatible adhesive.

2.2 ANCHOR BOLTS

Anchor bolts shall be provided for equipment placed on concrete equipment pads or on concrete slabs. Bolts shall be of the size and number recommended by the equipment manufacturer and shall be located by means of suitable templates. Installation of anchor bolts shall not degrade the surrounding concrete.

2.3 SEISMIC ANCHORAGE

Equipment shall be anchored in accordance with applicable seismic criteria for the area and as defined in SMACNA 1650

2.4 PAINTING

Equipment units shall be painted in accordance with approved equipment manufacturer's standards unless specified otherwise. Field retouching shall be accomplished only if approved; otherwise equipment shall be returned to the factory for refinishing.

PART 3 EXECUTION

3.1 INSTALLATION

Materials and equipment shall be installed in accordance with the requirements of the contract drawings and approved recommendations of the manufacturers. Installation shall be accomplished by workers skilled in this type of work. Installation shall be made so that there is no degradation of the designed fire ratings of walls, partitions, ceilings, and floors.

No installation shall be permitted which blocks or otherwise impedes access to any existing machine or system. All hinged doors shall swing open a minimum of 120 degrees. The area in front of all access doors shall be clear a minimum of 3 feet. The area in front of all access doors to electrical circuits shall be clear the minimum distance to energized circuits as specified in OSHA Standards, part 1910.333(Electrical-Safety Related work practices)and an additional 3 feet.

Except as otherwise indicated, emergency switches and alarms shall be installed in conspicuous locations. All indicators, to include gauges, meters, and alarms shall be mounted in order to be easily visible by people in the area.

3.2 EQUIPMENT PADS

Equipment pads shall be provided and shall be of dimensions shown or, if not shown, they shall conform to the shape of each piece of equipment served with a minimum 3-inch margin around the equipment and supports. Equipment bases and foundations, when constructed of concrete or grout, shall cure a minimum of 14 calendar days before being loaded.

3.3 CUTTING AND PATCHING

Contractor shall install his work in such a manner and at such time as will require a minimum of cutting and patching of the building structure.

Holes in exposed locations, in or through existing floors, shall be drilled and smoothed by sanding. Use of a jackhammer will be permitted only where specifically approved.

Holes through masonry walls to accommodate sleeves shall be made with an iron pipe masonry core saw.

3.4 CLEANING

Exposed surfaces of piping and equipment that have become covered with dirt, plaster, or other material during handling and construction shall be thoroughly cleaned before such surfaces are prepared for final finish painting or are enclosed within the building structure.

Before final acceptance, mechanical equipment, including piping, ducting, and fixtures, shall be clean and free from dirt, grease, and finger marks.

When the work area is in an occupied space such as office, laboratory or

warehouse all furniture and equipment shall be protected from dirt and debris. Field construction work shall incorporate housekeeping which leaves all furniture and equipment in the affected area free of construction generated dust and debris; and, all floor surfaces vacuum-swept clean.

-- End of Section --

SECTION 15050

BASIC MECHANICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B40.1 (1991; R 1997) Gauges - Pressure
Indicating Dial Type - Elastic Element

AMERICAN WELDING SOCIETY (AWS)

AWS WHB-2.8 (1991; 8th Ed) Welding Handbook; Volume
Two - Welding Processes

ASME INTERNATIONAL (ASME)

ASME A112.18.1 (2003) Plumbing Fixture Fittings

ASME A112.19.2M (1998) Vitreous China Plumbing Fixtures
Supplement 1-June 2000

ASME B1.20.7 (1991; R 1998) Hose Coupling Screw Threads
(Inch)

ASME B16.1 (1998) Cast Iron Pipe Flanges and Flanged
Fittings Classes 25, 125, and 250

ASME B16.22 (2002) Wrought Copper and Copper Alloy
Solder Joint Pressure Fittings

ASME B16.25 (1997) Buttwelding Ends

ASME B16.3 (1998) Malleable Iron Threaded Fittings
Classes 150 and 300

ASME B16.39 (1998) Malleable Iron Threaded Pipe Unions
Classes 150, 250, and 300

ASME B16.5 (1996) Pipe Flanges and Flanged Fittings
NPS 1/2 Through NPS 24

ASME B16.9 (2001) Factory-Made Wrought Steel
Buttwelding Fittings

ASME B31.3 (2002) Process Piping

ASME BPVC SEC IX	(2001) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME BPVC SEC VIII D1	(2001) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

ASTM INTERNATIONAL (ASTM)

ASTM A 126/A 126M	(1995) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A 183	(2003) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A 197/A 197M	(2000) Standard Specification for Cupola Malleable Iron
ASTM A 234/A 234M	(2003) Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperatures
ASTM A 278	(1993) Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650 Degrees F
ASTM A 307	(2003) Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A 53/A 53M	(2002) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 563	(2004) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A 6/A 6M	(2004a) Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM B 32	(2003) Standard Specification for Solder Metal
ASTM B 62	(2002) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B 88	(2003) Standard Specification for Seamless Copper Water Tube
ASTM C 404	(2003) Standard Specification for Aggregates for Masonry Grout

ASTM C 476	(2002) Standard Specification for Grout for Masonry
ASTM C 553	(2002) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 920	(2002) Standard Specification for Elastomeric Joint Sealants
ASTM D 2000	(2003a) Standard Classification System for Rubber Products in Automotive Applications
ASTM E 1	(2003a) Standard Specification for ASTM Liquid-in-Glass Thermometers
ASTM E 814	(2002) Standard Test Method for Fire Tests of Through-Penetration Fire Stops
ASTM F 104	(2003) Standard Classification System for Nonmetallic Gasket Materials

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-125	(2000) Gray Iron and Ductile Iron In-Line, Spring-Loaded, Center-Guided Check Valves
MSS SP-58	(2002) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-67	(2002) Butterfly Valves
MSS SP-69	(2002) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1998) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(1997) Gray Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-72	(1999) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-85	(2002) Cast Iron Globe and Angle Valves Flanged and Threaded Ends

U.S. DEPARTMENT OF DEFENSE (DOD)

MS MIL-C-18480	(1987b) Coating Compound, Bituminous, Solvent, Coal-Tar Base
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U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS FF-S-325 (Int Amd 3) Shield, Expansion; Nail,
Expansion; and Nail, Drive Screw (Devices,
Anchoring, Masonry)

UNDERWRITERS LABORATORIES (UL)

UL 1479 (2003) UL Standard for Safety Fire Tests
of Through-Penetration Fire Stops

1.2 GENERAL REQUIREMENTS

Section 15003 GENERAL MECHANICAL PROVISIONS applies to work specified in this section.

Section 15055 WELDING MECHANICAL applies to work specified in this section.

Records of Existing Conditions shall be submitted consisting of the results of Contractor's survey of work area conditions and features of existing structures and facilities within and adjacent to the jobsite. Commencement of work shall constitute Contractor's acceptance of the existing conditions.

Equipment Foundation Data for piping systems shall include plan dimensions of foundations and relative elevations, equipment weight and operating loads, horizontal and vertical loads, horizontal and vertical clearances for installation, and size and location of anchor bolts.

Fabrication Drawings shall be submitted for pipes, valves and specialties consisting of fabrication and assembly details to be performed in the factory.

Material, Equipment, and Fixture Lists shall be submitted for pipes, valves and specialties including manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site information. A complete list of construction equipment to be used shall be provided.

Manufacturer's Standard Color Charts shall be submitted for pipes, valves and specialties showing the manufacturer's recommended color and finish selections.

Listing of Product Installations for piping systems shall include identification of at least 5 units, similar to those proposed for use, that have been in successful service for a minimum period of 5 years. List shall include purchaser, address of installation, service organization, and date of installation.

As-Built Drawings shall be submitted for pipes, valves and accessories providing current factual information including deviations and amendments to the drawings, and concealed and visible changes in the work.

Connection Diagrams shall be submitted for pipes, valves and specialties indicating the relations and connections of devices and apparatus by

showing the general physical layout of all controls, the interconnection of one system (or portion of system) with another, and internal tubing, wiring, and other devices.

Coordination Drawings shall be submitted for pipes, valves and specialties showing coordination of work between different trades and with the structural and architectural elements of work. Drawings shall be in sufficient detail to show overall dimensions of related items, clearances, and relative locations of work in allotted spaces. Drawings shall indicate where conflicts or clearance problems exist between various trades.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists shall be submitted for construction equipment to be used.

SD-02 Shop Drawings

The following shall be submitted for pipes, valves and specialties showing conformance with the referenced standards contained within this section.

As-Built Drawings
Connection Diagrams
Coordination Drawings
Fabrication Drawings

Installation Drawings shall be submitted for pipes, valves and specialties in accordance with the paragraph entitled, "Pipe Installation," of this section.

SD-03 Product Data

Equipment and performance data shall be submitted for the following items consisting of corrosion resistance, life expectancy, gage tolerances, and grade line analysis.

Manufacturer's catalog data shall be submitted for the following items:

Pipe and Fittings
Piping Specialties
Valves
Miscellaneous Materials
Supporting Elements
Glycol

Equipment Foundation Data shall be in accordance with paragraph

entitled, "General Requirements," of this section.

SD-04 Samples

Manufacturer's Standard Color Charts shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

SD-06 Test Reports

Test reports on the following tests shall be submitted in accordance with paragraph entitled, "Piping Installation," of this section.

- Hydrostatic Tests
- Air Tests
- Valve-Operating Tests
- Drainage Tests
- Pneumatic Tests
- Non-Destructive Electric Tests
- System Operation Tests

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be submitted in accordance with paragraph entitled, "Operation and Maintenance," of this section.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

2.1.1 Type BCS, Black Carbon Steel

Pipe (1/8 through 10 inches) shall be Schedule 40 seamless or electric-resistance welded black carbon steel, conforming to ASTM A 53/A 53M, Type E, Grade B (electric-resistance welded). Grade A should be used for permissible field bending, in both cases.

Fittings (2 inches and under) shall be 150-pounds per square inch, gage (psig) working steam pressure (wsp) banded black malleable iron screwed, conforming to ASTM A 197/A 197M and ASME B16.3.

Unions (2 inches and under) shall be 250 pounds per square inch, wsp female, screwed, black malleable iron with brass-to-iron seat, and ground joint, conforming to ASME B16.39.

Fittings (2-1/2 inches and over) shall be Steel butt weld, conforming to ASTM A 234/A 234M and ASME B16.9 to match pipe wall thickness.

Flanges (2-1/2 inches and over) shall be 150-pound forged-steel conforming to ASME B16.5, welding neck to match pipe wall thickness.

2.1.2 Type CPR, Copper

2.1.2.1 Type CPR-A, Copper Above Ground

Tubing (2 inches and under) shall be seamless copper tubing, conforming to ASTM B 88, Type L (hard-drawn for all horizontal and all exposed vertical lines, annealed for concealed vertical lines).

Fittings (2 inches and under) shall be 150-psig wsp wrought-copper solder joint fittings conforming to ASME B16.22.

Unions (2 inches and under) shall be 150-psig wsp wrought-copper solder joint, conforming to ASME B16.22.

Solder shall be 95-5 tin-antimony, alloy Sb-5, conforming to ASTM B 32.

2.1.3 Grooved Pipe Couplings and Fittings

Couplings shall have a housing, fabricated in two or more parts, of black, ungalvanized malleable iron castings. Coupling gasket shall be molded synthetic rubber, conforming to ASTM D 2000. Coupling bolts shall be oval-neck, track-head type, with hexagonal heavy nuts conforming to ASTM A 183.

All pipe fittings used with couplings shall be fabricated of black, ungalvanized malleable iron castings. Where a manufacturer's standard-size malleable iron fitting pattern is not available, approved fabricated fittings may be used.

Fittings shall be fabricated from Schedule 40 or 0.75-inch wall ASTM A 53/A 53M, Grade B seamless steel pipe; long radius seamless welding fittings with wall thickness to match pipe, conforming to ASTM A 234/A 234M and ASME B16.9.

2.2 PIPING SPECIALTIES

2.2.1 Air Separator

Air separated from converter discharge water shall be ejected by a reduced-velocity device vented to the compression tank or as shown on drawings.

Air separator shall be carbon steel, designed, fabricated, tested, and stamped in conformance with ASME BPVC SEC VIII D1 for service pressures not less than 125 psi.

2.2.2 Air Vents

Manual air vents shall be 3/8-inch globe valves or 1/2-inch hose-end draining valves. All manual airvents shall have threaded cap and chain.

Automatic air vents on pumps, mains, and where indicated shall be of ball-float construction. Vent inlet shall be not less than 3/4-inch ips, and the outlet shall be not less than 1/4-inch ips. Orifice shall be 1/8 inch. Vent shall be fitted with try-cock. Vent shall discharge air at any

pressure to 150 psi. Outlet shall be copper tube routed.

2.2.3 Compression Tank

Compression tank shall be designed, fabricated, tested, and stamped for a working pressure of not less than 125 psi in accordance with ASME BPVC SEC VIII D1. Tank shall be hot-dip galvanized after fabrication to produce not less than 1.5 ounces of zinc coating per square foot of single-side surface.

Tank accessories shall include red-lined gage-glass complete with glass protectors and shutoff valves, air charger and drainer, and manual vent.

2.2.4 Dielectric Connections

Dissimilar pipe metals shall be electrically insulated from each other by couplings, unions, or flanges commercially manufactured for that purpose and rated for the service pressure and temperature.

2.2.5 Expansion Vibration Isolation Joints

Single or multiple arch-flanged expansion vibration isolation joints shall be constructed of steel-ring reinforced chloroprene-impregnated cloth materials. Joint shall be designed to absorb the movement of the pipe sections in which installed with no detrimental effect on the pipe or connected equipment. Flanges shall be backed with ferrous-metal backing rings. Control rod assemblies shall be provided to restrict joint movement. All nonmetallic exterior surfaces of the joint shall be coated with chlorosulphinated polyethylene. Grommets shall be provided in limit bolt hole to absorb noise transmitted through the bolts.

Joints shall be suitable for continuous-duty working temperature of at least 250 degrees F .

2.2.6 Hose Faucets

Hose faucets shall be constructed with 1/2 inch male inlet threads, hexagon shoulder, and 3/4 inch hose connection, conforming to ASME A112.18.1. Hose-coupling screw threads shall conform to ASME B1.20.7.

Vandalproof, atmospheric-type vacuum breaker shall be provided on the discharge of all potable water lines.

2.2.7 Pressure Gages

Pressure gages shall conform to ANSI B40.1 and to requirements specified herein. Pressure-gage size shall be 3-1/2 inches nominal diameter. Case shall be corrosion-resistant steel, conforming to any of the AISI 300 series of ASTM A 6/A 6M, with an ASM No. 4 standard commercial polish or better. Gages shall be equipped with adjustable red marking pointer and damper-screw adjustment in inlet connection. Service-pressure reading shall be at midpoint of gage range. All gages shall be Grade B or better and be equipped with gage isolators.

2.2.8 Sleeve Couplings

Sleeve couplings for plain-end pipe shall consist of one steel middle ring, two steel followers, two chloroprene or Buna-N elastomer gaskets, and the necessary steel bolts and nuts.

2.2.9 Thermometers

Thermometers shall conform to ASTM E 1, except for being filled with a red organic liquid. Thermometers shall be an industrial pattern armored glass model, (well-threaded and seal-welded). Thermometers installed 6 feet or higher above the floor shall have an adjustable angle body. Scale shall be not less than 7 inches long. Case face shall be manufactured from manufacturer's standard polished aluminum or AISI 300 series polished corrosion-resistant steel. Thermometer range shall be as noted on drawings. Thermometers shall be provided with nonferrous separable wells. Lagging extension to accommodate insulation thickness shall be provided.

2.2.10 Line Strainers, Water Service

Strainers shall be Y-type with removable basket. Strainers in sizes 2-inch ips and smaller shall have screwed ends. In sizes 2-1/2-inch ips and larger, strainers shall have flanged ends. Body working-pressure rating shall exceed maximum service pressure of system in which installed by at least 50 percent. Body shall have cast-in arrows to indicate direction of flow. All strainer bodies fitted with screwed screen retainers shall have straight threads and shall be gasketed with nonferrous metal. Strainer bodies 2-1/2-inches and larger, fitted with bolted-on screen retainers, shall have offset blowdown holes. All strainers larger than 2-1/2-inches shall be fitted with manufacturer's standard ball-type blowdown valve. Body material shall be cast bronze conforming to ASTM B 62. Where system material is nonferrous, metal strainer body material shall be nonferrous metal.

Minimum free-hole area of strainer element shall be equal to not less than 3.4 times the internal area of connecting piping. Strainer screens shall have perforations not to exceed 0.045-inch. Strainer screens shall have finished ends fitted to machined screen chamber surfaces to preclude bypass flow. Strainer element material shall be AISI Type 304 corrosion-resistant steel.

2.3 VALVES

2.3.1 Ball and Butterfly Valves

Ball valves shall conform to MSS SP-72 for Figure, 1 piece body, and shall be rated for service at not less than 175 psig at 200 degrees F. Valve bodies in sizes 2 inches and smaller shall be screwed-end connection-type constructed of Class A copper alloy. Valve bodies in sizes 2-1/2 inches and larger shall be flanged-end connection type, constructed of Class D material. Balls and stems of valves 2 inches and smaller shall be manufacturer's standard with hard chrome plating finish. Balls and stems of valves 2-1/2 inches and larger shall be manufacturer's standard Class C corrosion-resistant steel alloy with hard chrome plating. Balls of valves 6 inches and larger may be Class D with 900 Brinell hard chrome plating.

Valves shall be suitable for flow from either direction and shall seal equally tight in either direction. Valves with ball seals held in place by spring washers are not acceptable. All valves shall have adjustable packing glands. Seats and seals shall be tetrafluoroethylene.

Butterfly valves shall conform to MSS SP-67. Valves shall be wafer type for mounting between specified flanges and shall be rated for 150-psig shutoff and nonshock working pressure. Bodies shall be cast ferrous metal conforming to ASTM A 126/A 126M, Class B, and to ASME B16.1 for body wall thickness. Seats and seals shall be of the resilient elastomer type designed for field removal and replacement.

2.3.2 Drain, Vent, and Gage Cocks

Drain, vent, and gage cocks shall be lever handle, ground key type, with washer and screw, constructed of polished ASTM B 62 bronze, and rated 125-psi wsp. End connections shall be rated for specified service pressure.

Pump vent cocks, and where spray control is required, shall be UL umbrella-hood type, constructed of manufacturer's standard polished brass. Cocks shall be 1/2-inch ips male, end threaded, and rated at not less than 125 psi at 225 degrees F.

2.3.3 Globe and Angle Valves (GLV-ANV)

Globe and angle valves 2 inches and smaller, shall be 125-pound, 125-psi conforming to MSS SP-85 and to requirements specified herein. Valves located in tunnels, equipment rooms, factory-assembled equipment, and where indicated shall be union-ring bonnet, screwed-end type. Disc shall be free to swivel on the stem in all valve sizes. Composition seating-surface disc construction may be substituted for all metal-disc construction. Packing shall be made of non-asbestos type materials. Disk and packing shall be suitable for pipe service installed.

Globe and angle valves 2-1/2 inches and larger, shall be cast iron with bronze trim. Valve bodies shall be cast iron conforming to ASTM A 126/A 126M, Class A, as specified for Class 1 valves under MSS SP-70. Valve ends shall be flanged in conformance with ASME B16.1. Valve construction shall be outside screw and yoke (OS&Y) type. Packing shall be made of non-asbestos type materials.

2.3.4 Standard Check Valves (SCV)

Standard check valves in sizes 2 inches and smaller shall be 125-psi swing check conforming to MSS SP-71, except as otherwise specified. Lift checks shall be provided where indicated. Swing-check pins shall be nonferrous and suitably hard for the service. Discs shall be composition type. Swing-check angle of closure shall be manufacturer's standard unless a specific angle is needed.

Check valves in sizes 2-1/2 inches and larger shall be cast iron, bronze trim, swing type. Valve bodies shall be cast iron, conforming to ASTM A 126/A 126M, Class A. Valve ends shall be flanged in conformance with ASME B16.1. Swing-check pin shall be AISI Type 304 or approved equal

corrosion-resistant steel. Angle of closure shall be manufacturer's standard unless a specific angle is needed. Valves shall have bolted and gasketed covers.

Check valves shall be provided with external spring-loaded, positive-closure devices and valve ends shall be mechanical joint or flanged.

2.3.5 Nonslam Check Valves (NSV)

Check valves at pump discharges in sizes 2 inches and larger shall be nonslam or silent-check type conforming to MSS SP-125. Valve disc or plate shall close before line flow can reverse to eliminate slam and water-hammer due to check-valve closure. Valve shall be Class 125 rated for 200-psi maximum, nonshock pressure at 150 degrees F in sizes to 12 inches. Valves shall be wafer type to fit between flanges conforming to ASME B16.1. Valve body may be cast iron, conforming to ASTM A 278, Class 40 or equivalent strength ductile iron. Disks shall be manufacturer's standard bronze, aluminum bronze, or corrosion-resistant steel. Pins, springs, and miscellaneous trim shall be manufacturer's standard corrosion-resistant steel. Disk and shaft seals shall be Buna-N elastomer tetrafluoroethylene.

2.3.6 Calibrated Balancing Valves (Circuit Setters) NPS 2 and Smaller

Bronze body, ball type, 125 psig working pressure, 250 deg F maximum operating temperature, and having threaded ends. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position.

2.3.7 Calibrated Balancing Valves (Circuit Setters), NPS 2-1/2 and Larmer

Cast-iron or steel body, ball type, 125 psig working pressure, 250 deg F maximum operating temperature, and having flanged or grooved connections. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position.

2.3.8 Automatic Flow-Control Valves

Automatic Flow-Control Valves: Factory set to maintain constant flow with plus or minus 5 percent over system pressure fluctuations, and equipped with a readout kit including flow meter, probes, hoses, flow charts, and carrying case. Each valve shall have an identification tag attached by chain, and be factory marked with the zone identification, valve number, and flow rate. Valve shall be line size and one of the following designs:

Gray-iron or brass body, designed for 175 psig at 200 deg F with stainless-steel piston and spring.

Brass or ferrous-metal body, designed for 300 psig at 250 deg F with corrosion-resistant, tamperproof, self-cleaning, piston-spring assembly easily removable for inspection or replacement.

Combination assemblies, including bronze ball valve and brass alloy control valve, with stainless-steel piston and spring, fitted with pressure and temperature test valves, and designed for 300 psig at 250 deg F.

2.3.9 Hydronic Finned-Tube Radiation Units

Ratings based on design tests performed by The Hydronics Institute. Finned Tubes: Copper or steel as indicated on schedule with mechanically bonded aluminum fins, supported to eliminate thermal expansion noise. Backplate: 18 gage steel, with flat black, heat-resisting enamel finish matching front enclosure. Provide full backplate where units are installed on window mullions. Provide partial backplate where units are mounted to solid walls. Enclosure: Steel minimum 16 gage, enclosure style as indicated on schedule. Each enclosure section including filler and end pieces shall lock together on the front bottoms. Brace and reinforce front minimum of 4 feet-0 inches o.c. without visible fasteners. Accessories:

End panels, inside and outside corners, and enclosure extensions

Access panels in front of valves.

Factory mounted dampers.

2.4 MISCELLANEOUS MATERIALS

2.4.1 Bituminous Coating

Bituminous coating shall be a solvent cutback, heavy-bodied material to produce not less than a 12-mil dry-film thickness in one coat, and shall be as recommended by the manufacturer to be compatible with factory-applied coating and rubber joints.

For previously coal-tar coated and uncoated ferrous surfaces underground, bituminous coating shall be solvent cutback coal-tar type, conforming to MS MIL-C-18480.

2.4.2 Bolting

Flange and general purpose bolting shall be hex-head and shall conform to ASTM A 307, Grade B (bolts, for flanged joints in piping systems where one or both flanges are cast iron). Heavy hex-nuts shall conform to ASTM A 563. Square-head bolts and nuts are not acceptable. Threads shall be coarse-thread series.

2.4.3 Elastomer Calk

Polysulfide- or polyurethane-base elastomer calking material shall be two-component type, conforming to ASTM C 920.

2.4.4 Escutcheons

Escutcheons shall be manufactured from nonferrous metals and shall be chrome-plated except when AISI 300 series corrosion-resistant steel is

provided. Metals and finish shall conform to ASME A112.19.2M.

Escutcheons shall be one-piece type where mounted on chrome-plated pipe or tubing, and one-piece of split-pattern type elsewhere. All escutcheons shall have provisions consisting of internal spring-tension devices and/or setscrews for maintaining a fixed position against a surface.

2.4.5 Flange Gaskets

Compressed non-asbestos sheet, conforming to ASTM F 104, coated on both sides with graphite or similar lubricant, with nitrile composition, binder rated to 750 degrees F.

2.4.6 Grout

Shrink-resistant grout shall be a premixed and packaged metallic-aggregate, mortar-grouting compound conforming to ASTM C 404 and ASTM C 476.

2.4.7 Pipe Thread Compounds

Tetrafluoroethylene tape not less than 2 to 3 mils thick shall be used in potable and process water and in chemical systems for pipe sizes to and including 1-inch ips. Tetrafluoroethylene dispersions and other suitable compounds may be used for all other applications upon approval by the Contracting Officer; however, no lead-containing compounds may be used in potable water systems.

2.5 SUPPORTING ELEMENTS

All necessary piping systems and equipment supporting elements shall be provided, including but not limited to: building structure attachments; supplementary steel; hanger rods, stanchions, and fixtures; vertical pipe attachments; horizontal pipe attachments; anchors; guides; and spring-cushion, variable, or constant supports. All supporting elements shall be suitable for stresses imposed by systems pressures and temperatures and natural and other external forces normal to this facility without damage to supporting element system or to work being supported.

Supporting elements shall conform to requirements of ASME B31.3, FS FF-S-325, MSS SP-58, and MSS SP-69 except as noted.

Attachments welded to pipe shall be made of materials identical to that of pipe or materials accepted as permissible raw materials by referenced code or standard specification.

Supporting elements exposed to weather shall be hot-dip galvanized or stainless steel. Materials shall be of such a nature that their apparent and latent-strength characteristics are not reduced due to galvanizing process. Supporting elements in contact with copper tubing shall be electroplated with copper.

Type designations specified herein are based on MSS SP-58 and MSS SP-69. Masonry anchor group-, type-, and style-combination designations shall be in accordance with FS FF-S-325. Support elements, except for supplementary

steel, shall be cataloged, load rated, commercially manufactured products.

2.5.1 Building Structure Attachments

2.5.1.1 Anchor Devices, Concrete and Masonry

Anchor devices shall conform to FS FF-S-325 for the following types:

Group I - shield, expansion (lead, bolt and stud anchors)

Group II - shield, expansion (bolt anchors)

Type 2 - machine bolt expansion shield anchors

Class 2 - open-end expansion shield anchors

Style 1 - single-end expansion shield anchors

Style 2 - double-end expansion shield anchors

Group III - shield, expansion (self-drilling

tubular expansion shell bolt anchors)

Group VIII - anchors, expansion (nondrilling)

Cast-in, floor mounted, equipment anchor devices shall provide adjustable positions.

Masonry anchor devices shall be built-in.

Powder-actuated anchoring devices shall not be used to support any mechanical systems components.

2.5.1.2 Beam Clamps

Beam clamps shall be center-loading MSS SP-58 Type as required to suit field conditions.

When it is not possible to use center-loading beam clamps, eccentric-loading beam clamps, MSS SP-58 Type as required to suite field conditions may be used for piping sizes 2 inches and less and for piping sizes 2 through 10 inches provided two counterbalancing clamps are used per point of pipe support. Where more than one rod is used per point of pipe support, rod diameter shall be determined in accordance with referenced standards.

2.5.1.3 C-Clamps

C-clamps shall not be used.

2.5.1.4 Inserts, Concrete

Concrete inserts shall be MSS SP-58 Type 18. When applied to piping in

sizes 2 inches ips and larger and where otherwise required by imposed loads, a 1-foot length of 1/2-inch reinforcing rod shall be inserted and wired through wing slots. Proprietary-type continuous inserts may be submitted for approval.

2.5.2 Horizontal Pipe Attachments

2.5.2.1 Single Pipes

Piping in sizes to and including 2-inch ips shall be supported by MSS SP-58 Type 6 solid malleable iron pipe rings, except that split-band-type rings may be used in sizes up to 1-inch ips.

MSS SP-58 Type 1 and Type 6 assemblies shall be used on vapor-sealed insulated piping and shall have an inside diameter larger than pipe being supported to provide adequate clearance during pipe movement.

MSS SP-58 Type 40 shields shall be used on all insulated piping. Area of the supporting surface shall be such that compression deformation of insulated surfaces does not occur. Longitudinal and transverse shield edges shall be rolled away from the insulation.

Insulated piping without vapor barrier on roll supports shall be provided with MSS SP-58 Type 39 saddles.

Spring supports shall be as indicated.

2.5.2.2 Parallel Pipes

Trapeze hangers fabricated from structural steel shapes, with U-bolts, shall be used in congested areas and where multiple pipe runs occur. Structural steel shapes shall be of commercially available, proprietary design, rolled steel.

2.5.3 Vertical Pipe Attachments

Vertical pipe attachments shall be MSS SP-58 Type 8.

Shop drawing data shall include complete fabrication and attachment details of any spring supports.

2.5.4 Hanger Rods and Fixtures

Only circular cross section rod hangers may be used to connect building structure attachments to pipe support devices. Pipe, straps, or bars of equivalent strength shall be used for hangers only where approved by the Contracting Officer.

Turnbuckles, swing eyes, and clevises shall be provided as required by support system to accommodate temperature change, pipe accessibility, and adjustment for load and pitch. Rod couplings are not acceptable.

2.6 GLYCOL

Propylene glycol specifically designed for closed loop HVAC systems, phosphate based, inhibited, low toxicity, must pass ASTM D 1384.

PART 3 EXECUTION

3.1 PIPE INSTALLATION

Certificates shall be submitted for pipes, valves and specialties showing conformance with test requirements as contained in the reference standards contained in this section. Certificates shall verify Surface Resistance, Shear and Tensile Strengths, Temperature Ratings, Bending Tests, Flattening Tests and Transverse Guided Weld Bend Tests.

Test reports for Hydrostatic Tests, Air Tests, Valve-Operating Tests, Drainage Tests, Pneumatic Tests, Non-Destructive Electric Tests and System Operation Tests shall be provided by the Contractor, in compliance with referenced standards contained within this section.

Piping systems shall be fabricated and installed in accordance with ASME B31.3, MSS SP-69, and AWS WHB-2.8.

Installation Drawings shall be submitted for pipes, valves and specialties. Drawings shall include the manufacturer's design and construction calculations, forces required to obtain rated axial, lateral, or angular movements, installation criteria, anchor and guide requirements for equipment, and equipment room layout and design. Drawing shall specifically advise on procedures to be followed and provisions required to protect expansion joints during specified hydrostatic testing operations.

Connections between steel piping and copper piping shall be electrically isolated from each other with flanged with gaskets rated for the service. Provide isolation valve upstream and downstream of dielectric fitting.

Final connections to equipment shall be made with [unions] [flanges] provided every 100 feet of straight run. Unions shall be provided in the line downstream of screwed- and welded-end valves.

All pipe ends shall be reamed before joint connections are made.

Screwed joints shall be made up with specified joint compound and not more than three threads shall show after joint is made up.

Joint compounds shall be applied to the male thread only and care shall be exercised to prevent compound from reaching the unthreaded interior of the pipe.

Screwed unions, welded unions, or bolted flanges shall be provided wherever required to permit convenient removal of equipment, valves, and piping accessories from the piping system for maintenance.

Piping systems shall be securely supported with due allowance for thrust forces, thermal expansion and contraction, and shall not be subjected to mechanical, chemical, vibrational or other damage as specified in ASME B31.3.

Field welded joints shall conform to the requirements of the AWS WHB-2.8, ASME B31.3, and ASME BPVC SEC IX.

Piping systems butt weld joints shall be made with backing rings. Backing ring materials shall be compatible with materials being joined. Joint configuration shall conform to ASME B16.25.

Preheat and postheat treatment of welds shall be done in accordance with ASME BPVC SEC IX and ASME B31.3.

All necessary precautions shall be taken during installation of flexible pipe and hose including flushing and purging with water, steam, and compressed air to preclude bellows failure due to pipe line debris lodged in bellows. Installation shall conform to manufacturer's instructions.

3.2 VALVES

Valves shall be provided in piping mains and all branches and at equipment where indicated and as specified.

Valves shall be provided to permit isolation of branch piping and each equipment item from the balance of the system.

Riser and downcomer drains above piping shutoff valves in piping 2-1/2 inches and larger shall be provided. Shutoff valve body shall be tapped and fitted with a 1/2-inch plugged globe valve.

Valves unavoidably located in furred or other normally inaccessible places shall be provided with access panels adequately sized for the location and located so that concealed items may be serviced, maintained, or replaced.

3.3 SUPPORTING ELEMENTS INSTALLATION

Supporting elements shall be provided in accordance with the referenced codes and standards.

Piping shall be supported from building structure. No piping shall be supported from roof deck or from other pipe.

Piping shall run parallel with the lines of the building. Piping and components shall be spaced and installed so that a threaded pipe fitting may be removed between adjacent pipes and so that there shall be no less than 1/2 inch of clear space between the finished surface and other work and between the finished surface of parallel adjacent piping. Hangers on different adjacent service lines running parallel with each other shall be arranged to be in line with each other and parallel to the lines of the building.

Piping support elements shall be installed at intervals specified hereinafter, at locations not more than 3 feet from the ends of each runout, and not over 1 foot from each change in direction of piping.

Load rating for all pipe-hanger supports shall be based on insulated weight of lines filled with water and forces imposed. Deflection per span shall

not exceed slope gradient of pipe. Supports shall be in accordance with the following minimum rod size and maximum allowable hanger spacing for specified pipe. For concentrated loads such as valves, the allowable span shall be reduced proportionately:

PIPE SIZE <u>INCHES</u>	ROD SIZE <u>INCHES</u>	STEEL PIPE <u>FEET</u>	COPPER PIPE <u>FEET</u>
1 and smaller	3/8	8	6
1-1/4 to 1-1/2	3/8	10	8
2	3/8	10	8
2-1/2 to 3-1/2	1/2	12	12
4 to 5	5/8	16	14
6	3/4	16	16
8 to 12	7/8	20	20
14 to 18	1	20	20
20 and over	1-1/4	20	20

Vibration isolation supports shall be provided where needed. Refer to Section 15072 VIBRATION ISOLATION FOR AIR CONDITIONING EQUIPMENT where A/C equipment and piping is installed.

Vertical risers shall be supported independently of connected horizontal piping, whenever practicable, with fixed or spring supports at the base and at intervals to accommodate system range of thermal conditions. Risers shall be guided for lateral stability. For risers subject to expansion, only one rigid support shall be provided at a point approximately one-third down from the top. Clamps shall be placed under fittings unless otherwise specified. Carbon-steel pipe shall be supported at each floor and at not more than 15-foot intervals for pipe 2 inches and smaller and at not more than 20-foot intervals for pipe 2-1/2 inches and larger.

3.4 PENETRATIONS

Effective sound stopping and adequate operating clearance shall be provided to prevent structure contact where piping penetrates walls, floors, or ceilings into occupied spaces adjacent to equipment rooms; where similar penetrations occur between occupied spaces; and where penetrations occur from pipe chases into occupied spaces. Occupied spaces shall include space above ceilings where no special acoustic treatment of ceiling is provided. Penetrations shall be finished to be compatible with surface being penetrated.

Sound stopping and vapor-barrier sealing of pipe shafts and large floor and wall openings shall be accomplished by packing to high density with properly supported fibrous-glass insulation or, where ambient or surface

temperatures do not exceed 120 degrees F, by foaming-in-place with self-extinguishing, 2-pound density polyurethane foam to a depth not less than 6 inches. Foam shall be finished with a rasp. Vapor barrier shall be not less than 1/8-inch thick vinyl coating applied to visible and accessible surfaces. Where high temperatures and fire stopping are a consideration, only mineral wool shall be used and openings shall also be covered with 16-gage sheet metal.

3.5 SLEEVES

Sleeves shall be provided where piping passes through roofs, masonry, concrete walls and floors.

Sleeves passing through steel decks shall be continuously welded to the deck.

Sleeves that extend through floors, roofs, load bearing walls, and fire barriers shall be continuous and fabricated from Schedule 40 steel pipe, with welded anchor lugs. All other sleeves shall be formed by molded linear polyethylene liners or similar materials that are removable. Diameter of sleeves shall be large enough to accommodate pipe, insulation, and jacketing without touching the sleeve and shall provide a minimum 3/8-inch clearance. Sleeve size shall accommodate mechanical and thermal motion of pipe to preclude transmission of vibration to walls and the generation of noise.

Space between a pipe, bare or insulated, and the inside of a pipe sleeve or a construction surface penetration shall be packed solid with a mineral fiber conforming to ASTM C 553 Type V (flexible blanket), (to 1,000 degrees F). This packing shall be provided wherever the piping passes through firewalls, equipment room walls, floors, and ceilings connected to occupied spaces, and other locations where sleeves or construction-surface penetrations occur between occupied spaces. Where sleeves or construction surface penetrations occur between conditioned and unconditioned spaces, the space between a pipe, bare or insulated, and the inside of a pipe sleeve or construction surface penetration shall be filled with an elastomer calk to a depth of 1/2 inch. All surfaces to be calked shall be oil- and grease-free.

Through-Penetration fire stop materials and methods shall be in accordance with ASTM E 814 and UL 1479.

Exterior wall sleeves shall be calked watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed metal components.

Sleeve height above roof surface shall be a minimum of 12 and a maximum of 18 inches.

3.6 ESCUTCHEONS

Escutcheons shall be provided at all penetrations of piping into finished areas. Where finished areas are separated by partitions through which piping passes, escutcheons shall be provided on both sides of the

partition. Where suspended ceilings are installed, plates shall be provided at the underside only of such ceilings. For insulated pipes, the plates shall be large enough to fit around the insulation. Escutcheons shall be chrome-plated in all occupied spaces and of size sufficient to effectively conceal openings in building construction. Escutcheons shall be firmly attached with setscrews.

3.7 FLASHINGS

Flashings shall be provided at penetrations of building boundaries by mechanical systems and related work.

3.8 UNDERGROUND PIPING INSTALLATION

Prior to being lowered into a trench, all piping shall be cleaned, visually inspected for apparent defects, and tapped with a hammer to audibly detect hidden defects.

Suspect cast-ferrous piping shall be further inspected by painting with kerosene on external surfaces to reveal cracks.

Defective materials found shall be distinctly marked using a road-traffic quality yellow paint; defective material shall be promptly removed from the site.

After conduit has been inspected, and not less than 48 hours prior to being lowered into a trench, all external surfaces of cast ferrous conduit shall be coated with a compatible bituminous coating for protection against brackish ground water. Application shall be single coat, in accordance with the manufacturer's instructions, to result in a dry-film thickness of not less than 12 mils.

Excavations shall be dry and clear of extraneous materials when pipe is being laid.

Cutting of piping shall be by wheel cutters or other machines designed specifically for that purpose. Electric-arc and oxyacetylene cutting will not be permitted.

Laying of pipe shall begin at the low point of a system. When in final acceptance position, it shall be true to the grades and alignment indicated, with unbroken continuity of invert. Blocking and wedging will not be permitted.

Bell or grooved ends of piping shall point upstream.

Changes in direction shall be made with long sweep fittings, or as per manufacturer's requirement for engineered piping systems.

Necessary socket clamping, piers, bases, anchors, and thrust blocking shall be provided. Rods, clamps, and bolting shall be protected with a coating of bitumen.

On excavations that occur near and below building footings, the backfilling

material shall consist of 2,000-psi cured compressive-strength concrete poured or pressure-grouted up to the level of the footing.

Vertical downspouts; soil, waste, and vent stacks; water risers; and similar work shall be properly supported on approved piers at the base and provided with approved structural supports attached to building construction.

Cleanout, flushing, and observation risers shall be provided.

3.9 DISINFECTION

Water piping, including all valves, fittings, and other devices, shall be disinfected with a solution of chlorine and water. Solution shall contain not less than 50 parts per million (ppm) of available chlorine. Solution shall be held for a period of not less than 8 hours, after which the solution shall contain not less than 10 ppm of available chlorine or the piping shall be re-disinfected. After successful sterilization, the piping shall be thoroughly flushed before placing into service. Flushing shall be complete when the flush water contains less than 0.5 ppm of available chlorine. Water for disinfected will be furnished by the Government. Contractor shall be responsible for approved disposal of contaminated flush water in accordance with written instructions received from the Environmental authority having jurisdiction through the Contracting Officer and all Local, State and Federal Regulations.

Piping shall be flushed with potable water until visible grease, dirt and other contaminants are removed (visual inspection). Contractor shall submit water sample to a certified water testing laboratory. Test shall check for metal concentrations in water. After flushing, coat interior of domestic water piping as noted in specifications.

3.10 OPERATION AND MAINTENANCE

Operation and Maintenance Manuals shall be consistent with manufacturer's standard brochures, schematics, printed instructions, general operating procedures and safety precautions. Test data shall be clear and readily legible.

-- End of Section --

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SECTION 15055

WELDING MECHANICAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ASME INTERNATIONAL (ASME)

ASME B31.1	(2001) Power Piping
ASME B31.3	(2002) Process Piping
ASME B31.5	(2001) Refrigeration Piping and Heat Transfer Components
ASME BPVC SEC IX	(2001) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME BPVC SEC V	(2001) Boiler and Pressure Vessel Code; Section V, Nondestructive Examination
ASME BPVC SEC VIII D1	(2001) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

INTERNATIONAL CODE COUNCIL (ICC)

ICC IPC	(2003) International Plumbing Code
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PIPE FABRICATION INSTITUTE (PFI)

PFI ES 1	(1992) Internal Machining and Solid Machined Backing Rings for Circumferential Butt Welds
PFI ES 21	(1992; R 1995) Internal Machining and Fit-up of GTAW Root Pass Circumferential Butt Welds
PFI ES 3	(2001) Fabricating Tolerances
PFI ES 31	(1992) Standard for Protection of Ends of Fabricated Piping Assemblies
PFI ES 35	(1993) Nonsymmetrical Bevels and Joint Configurations for Butt Welds

PFI ES 7	(1994) Minimum Length and Spacing for Welded Nozzles
PFI TB1	(1994) Pressure Temperature Ratings of Seamless Pipe Used in Power Plant Piping Systems

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-04 Samples

Welder's Pre-Qualification Samples shall be submitted prior to start.

SD-06 Test Reports

Test reports shall be submitted for Radiographs.

SD-07 Certificates

Certificates for the following shall be submitted in accordance with paragraph entitled, "Quality Assurance," of this section.

Certified Welding Procedure Specifications (WPS)
Certified Brazing Procedure Specifications (BPS)
Certified Procedure Qualification Records (PQR)
Certified Welder Performance Qualifications (WPQ)
Certified Brazer Performance Qualifications (BPQ)

1.3 QUALITY ASSURANCE

Within fifteen calendar days after receipt of Notice to Proceed, the Contractor shall submit for approval to the Contracting Officer Certified Welding Procedure Specifications (WPS), Certified Brazing Procedure Specifications (BPS) and Certified Procedure Qualification Records. (PQR)

1.3.1 Personnel Qualifications

This specification contains the minimum requirements for qualifying welding procedures, welders, and welding operators for making and inspecting welds in mechanical fabrications of carbon steel, low alloy steel, extra-high-strength quenched and tempered low alloy steels, and austenitic stainless steel materials.

Welder's Pre-Qualification Samples shall be submitted by qualified welding operators performing work on contract prior to start. Only after acceptance of samples, will qualified welding operator be permitted to begin work.

1.3.2 Piping Qualifications

1.3.2.1 High Pressure Piping

Qualification documents for 125 psig or above, shall be in accordance with ASME BPVC SEC IX.

1.3.2.2 Low Pressure Piping

Refrigeration Piping: Qualification documents for below 125 psig, for "Refrigeration Piping" shall be in accordance with ASME B31.5.

Plumbing: Plumbing work shall be performed by a state licensed plumber registered in the state where the work is being performed.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 CONSTRUCTION

3.1.1 Piping

3.1.1.1 High Pressure (125 Psig or Above)

Other High Pressure Piping: Other high pressure piping systems shall be fabricated, assembled and welded/brazed in accordance with ASME B31.3, and Power Piping Codes, PFI ES 1, PFI ES 3, PFI ES 7, PFI ES 21, PFI ES 31, PFI ES 35, and PFI TB1, of the Piping Fabrication Institute's companion code requirements.

3.1.1.2 Low Pressure (Below 125 Psig)

Refrigeration Piping: Piping systems shall be fabricated, assembled and welded/brazed/soldered in accordance with the ASME B31.5.

Plumbing: Plumbing systems shall be fabricated, assembled and welded/brazed/soldered in accordance with ICC IPC.

Other Low Pressure Piping: Other low pressure piping systems shall be fabricated, assembled and welded/brazed/soldered in accordance with the ASME B31.1.

3.2 HEAT INPUT REQUIREMENTS

3.2.1 Preheat

Welding shall not be done at ambient temperature below 32 degrees F, or when the surfaces are wet or exposed to rain, snow, or high wind. Temperature of the metals in the area where the welding is to be done shall be not less than 50 degrees F. When the ambient conditions are such that the normal temperature of the base metal is below 50 degrees F, the area surrounding the joint shall be preheated to provide a base metal

temperature of 100 degrees F for a distance of at least 3 inches in all directions from the joint to be welded. Preheat shall be in accordance with ASME BPVC SEC VIII D1 and ASME BPVC SEC V.

3.2.2 Interpass

In a multipass weld, the interpass temperature is the temperature of the weld metal before the next pass is started. Interpass requirements shall be in accordance with ASME BPVC SEC VIII D1.

3.2.3 Postweld

Weldments shall not be given a postweld heat treatment unless noted in the applicable code qualified/certified welding documentation, WPS, PQR and WPQ.

3.3 INSPECTION/NONDESTRUCTIVE TESTING (NDT)

3.3.1 General

Fabrication/Erection inspection shall be performed prior to assembly, during assembly, during welding and after welding to ensure that materials and workmanship meet the requirements of the contract documents.

Each specified radiograph shall, as a minimum, have the following additional information permanently included in the image:

Agency Weld No. (including repair cycle no.)

Agency drawing No.

Agency View No.

Agency Contract No.

Final interpretation and acceptance of all Radiographs of welded joints, with the exception of code stamped pressure vessel welds, will be by the Contracting Officer.

Final acceptance of all welded/brazed joints shall be by the Contracting Officer.

Prior to the Contracting Officer's inspection, all slag and scale shall be removed from all welds. Procedure employed shall not produce notches in either the weld metal or adjacent base metal.

Unacceptable welds shall be immediately repaired and made ready for Government reinspection at no additional cost to the Government.

After weld joints have been satisfactorily completed by the Contractor and accepted by the Contracting Officer, the joint area shall be cleaned to a bright, unpitted, and unscarred surface and then protected in accordance with the contract documents.

3.3.2 Piping

3.3.2.1 Test Method

NDT (Nondestructive Testing) of all piping systems, except plumbing systems, shall be performed in accordance with the requirements of ASME BPVC SEC V.

For high pressure (125 psig or above) systems. Not less than 10 percent of all butt welds shall be examined fully by random radiography. Welds to be examined shall be selected to ensure that the work product of each welder or welding operator doing the production welding is included. These welds shall satisfy the acceptance standards of the specified code. If any of the butt welds examined reveals an unacceptable indication, all butt welds welded by that welder(s) shall be examined/accepted by radiography.

3.3.2.2 Acceptance Requirements

High Pressure (125 psig or above):

- b. Other high pressure piping systems shall meet the requirements of ASME B31.3.

Low Pressure (Below 125 psig):

- a. Refrigeration piping systems shall meet the requirements of ASME B31.5.
- b. Plumbing piping systems shall meet the requirements of ICC IPC.
- c. Other low pressure piping systems shall meet the requirements of ASME B31.1.

3.4 PROTECTION OF ADJACENT MATERIALS

Contractor shall sufficiently protect machinery, materials, floor, furnishings, finishes and other items adjacent to the welding/brazing operations to prevent any damage from these operations.

-- End of Section --

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SECTION 15083

DUCT INSULATION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ASTM INTERNATIONAL (ASTM)

ASTM B 209/B 209M	(2004) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 1136	(2000a) Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C 553	(2002) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 592	(2000) Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type)
ASTM C 795	(2003) Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
ASTM C 916	(1985; R 2000e1) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM D 579	(1997) Standard Specification for Greige Woven Glass Fabrics
ASTM E 84	(2003) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E 96	(2000e1) Standard Test Methods for Water Vapor Transmission of Materials

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 220	(1999) Standard on Types of Building Construction
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1.2 SYSTEM DESCRIPTION

Section 15003, "General Mechanical Provisions," Section 15815, "Low Pressure Ductwork," and Section 15818, "Medium/High Pressure Ductwork," apply to work specified in this section.

This section pertains to field applied thermal insulation installed on the external surfaces of ducts and plenums.

1.3 PERFORMANCE REQUIREMENTS

Thermal-insulation system materials shall be noncombustible, as defined by NFPA 220. Adhesives, coatings, sealants, facings, jackets, and thermal-insulation materials, except cellular elastomers, shall have a maximum flame-spread classification (FSC) of 25 and a smoke-developed classification (SDC) of 50. Flame-contributed classification (FCC) shall be as specified for the application. These maximum values shall be determined in accordance with ASTM E 84. Adhesives, coatings, and sealants shall be nonflammable in their wet state.

Adhesives, coatings, and sealants shall have published or certified temperature ratings suitable for the entire range of working temperatures normal for the surfaces to which they are to be applied.

1.4 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

- Adhesives
- Coatings
- Thermal-Insulation Materials
- Jacketing Materials
- Duct liner-

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either the wet or dry state. Materials to be used on stainless steel surfaces shall meet ASTM C 795 requirements. Materials shall be asbestos free and conform to the following.

2.1.1 Adhesives

2.1.1.1 Cloth

Adhesives for adhering, sizing, and finishing open-weave glass cloth shall be pigmented polyvinyl acetate emulsion and shall conform to the requirements of ASTM C 916, Type I.

2.1.1.2 Adhesive Vapor Barrier

Adhesives for attaching laps of vapor-barrier materials and presized glass cloth and for attaching insulation to itself, to metal, and to various other substrates, shall be the solvent-base synthetic-rubber type and shall conform to the requirements of ASTM C 916, Type I, for attaching fibrous-glass insulation to metal surfaces. Solvents shall be nonflammable.

2.1.2 Coatings

2.1.2.1 Outdoor Vapor-Barrier Finishing

Coatings for outdoor vapor-barrier and weather-barrier finishing of insulation shall comply with manufacturer's recommendation for material compatibility, service life, and environment.

2.1.2.2 Indoor Vapor-Barrier Finishing

Coatings for indoor vapor-barrier finishing of insulation surfaces shall be pigmented resin and solvent compound and shall conform to ASTM C 1136.

2.1.2.3 Outdoor and Indoor Nonvapor-Barrier Finishing

Coatings for outdoor and indoor nonvapor-barrier finishing of insulation surfaces shall be pigmented polymer emulsion recommended by the insulation-material manufacturer for the surface to be coated and shall be applied to the specified dry-film thickness.

2.1.2.4 Coating Color

Coating color shall be white.

2.1.3 Insulation

Insulation conductances shall be maximum values, as tested at any point, not an average. Insulation conductance found by test to exceed the stipulated maximum shall either be replaced or augmented by an additional thickness to bring it to the required maximum conductance.

Insulation materials requirements for exterior applications are acceptable for interior applications.

Thermal-Insulation Materials shall meet referenced standards within this section.

2.1.3.1 Interior Insulation

Mineral fiber shall conform to ASTM C 592, shall be suitable for surface temperatures up to 370 degrees F, and shall be not less than 4-pound per cubic foot density, unless otherwise specified. Thermal conductivity shall

be not greater than 0.26 Btu inch per hour per square foot per degree F at 150 degrees F, unless otherwise specified.

2.1.3.2 Rigid Boards

Rigid boards shall be Form A, blocks and boards, Class 1, for use at temperatures up to 400 degrees F, nonloadbearing, minimum 3-pound per cubic foot density. Thermal conductivity shall be not greater than 0.24 Btu inch per square foot per hour per degree F at 75 degrees F.

2.1.3.3 Flexible Blankets

Flexible blankets shall be Type 1 blankets and felts, flexible, resilient for use at temperatures up to 400 degrees F, minimum 1-pound per cubic foot density. Thermal conductivity shall be not greater than 0.36 Btu by inch per square foot per hour per degree F at 75 degrees F. Insulation shall conform to ASTM C 553.

2.1.4 Jacketing

Jacketing Materials shall meet referenced standards within this section.

2.1.4.1 Composite Jacketing

Jacketing shall be a 3-ply laminate of 35-pound per cubic foot white-bleached kraft bonded to not less than 1-mil thick aluminum foil and reinforced with glass fiber. Fire-resistance classification shall be as follows:

	<u>FOIL EXPOSED</u>	<u>KRAFT EXPOSED</u>
FSC	5	25
FCC	0	10
SDC	0	15

Water-vapor permeance rating of the composite shall be 0.02 perm or grain per hour per square foot per inch of mercury pressure-differential determined in accordance with ASTM E 96.

2.1.4.2 Sheetmetal Jacketing

Sheetmetal jacketing shall be aluminum in conformance with ASTM B 209/B 209M, having lock-forming corner bead and joint capability.

2.1.4.3 Glass Cloth

Glass cloth shall be plain weave conforming to ASTM D 579, Style 141, and shall weigh not less than 7.23 ounces per square yard before sizing. Cloth shall be factory-applied wherever possible.

2.1.4.4 Vapor Barrier Material

Vapor barrier material shall conform to ASTM C 1136, Type I, low vapor transmission, high puncture resistance for use on insulation for piping, ducts, and equipment, and as indicated.

PART 3 EXECUTION

3.1 INSTALLATION OF INSULATION SYSTEMS

Contours on exposed work shall be smooth and continuous. Cemented laps, flaps, bands, and tapes shall be smoothly and securely pasted down. Adhesives shall be applied on a 100-percent coverage basis. Departure from these requirements shall be a basis for rejection.

Joints shall be tight, with insulation lengths tightly butted against each other. Where lengths are cut, cuts shall be smooth and square and without breakage of end surfaces. Where insulation terminates, ends shall be neatly tapered and effectively sealed or finished. Longitudinal seams of exposed insulation shall be directed away from normal view.

Surfaces shall be clean and free of all oil and grease before insulation adhesives or mastics are applied. Solvent cleaning required to bring metal surfaces to such condition shall be provided.

Insulation shall not impede access to duct covers/doors used for duct cleaning and/or maintenance.

3.2 SYSTEM TYPES

3.2.1 Type T-11, Flexible Mineral Fiber with Jacket

Sheet metal ducts shall be covered with mineral-fiber duct insulation with factory-attached vapor-barrier jacket. Vapor seal shall be maintained. Jacket overlap shall be not less than 2 inches.

Insulation nominal thickness shall be 1-1/2-inches.

Insulation shall be adhered to sheet metal surfaces with vapor-barrier adhesive.

Insulation on all rectangular ducting with side- or bottom-surface dimensions over 30 inches shall, in addition to being adhered with adhesive, be impaled on pins secured to the duct surface and then locked by means of flush pin caps. Pins shall be clipped flush with face of cap. Pins shall be 12 inches on center placed not more than 2 inches from duct edges, and there shall be not less than two rows of pins per surface. Pins shall be sealed with outdoor vapor-barrier coating and vapor-barrier duct tape.

When insulation is in place, total thickness shall be reduced by not more than 0.5 inch, and no condensation shall appear on any surface.

Jackets, jacket flaps, and bands shall be securely cemented in place with vapor-barrier adhesive. Jacketing bands for butt joints shall be not less than 4 inches wide. In lieu of jacketing bands, pressure-sensitive

vapor-barrier tape not less than 3 inches wide shall be used to seal horizontal and transverse seams.

Duct insulation shall be rigid-board 3-pound per cubic foot density where penetrations through sleeves or prepared openings occur.

Duct insulation at fire dampers shall be provided.

Duct insulation terminating at insulated or uninsulated sheet metal and equipment surfaces, supports, damper fittings, walls, and similar penetration and construction points shall be sealed with outdoor vapor-barrier coating and, where lengths exceeding 24 inches are involved, flashed with glass-cloth tape and sheet metal trimming. Glass-cloth tape shall be in two layers with not less than 3 inches of overlap imbedded in not less than 1/16 inch dry-film thickness of outdoor vapor-barrier coating.

3.2.2 Type T-13, Rigid Mineral Fiber with Jacket

Sheet metal ducts shall be covered with insulation with factory-applied vapor barrier and finished with field-applied glass-cloth jacket. Vapor seal shall be maintained. Jacket overlap shall be not less than 2 inches.

Insulation nominal thickness shall be 2 inches.

Insulation shall be adhered to sheet metal surfaces with vapor-barrier adhesive.

Insulation on sheet metal with side- or bottom-surface dimensions over 30 inches, in addition to being adhered with adhesive, shall be impaled on pins secured to the duct surface and then locked by means of flush pin caps clipped flush with face of cap. Pins shall be 12 inches on center placed not more than 2 inches from duct edges, and there shall be not less than two rows of pins per surface. Pins shall be sealed with outdoor vapor-barrier coating and vapor-barrier duct tape. Pinned area and other surfaces shall be level with adjoining insulated surface. Edges shall be square and straight without scallops; where necessary, areas shall be leveled with a mixture of finish insulating cement and nonvapor-barrier adhesive diluted with three parts water.

Vapor-barrier jackets, jacket flaps, and bands shall be securely cemented in place with vapor-barrier adhesive. Jacketing bands for butt joints shall be not less than 4 inches wide.

Duct insulation at fire dampers shall be provided.

Insulation shall be brought tightly against raised-flange standing seams and sealed with vapor-barrier coating. A 3 inch wide strip of the insulation of adequate thickness to give 0.5 inch covering over flange shall be provided. Strip shall be routed out to accommodate the still-exposed portion of the seam or flange and shall be cemented in place over the seam or flange by use of vapor-barrier coating material.

Duct insulation terminating at insulated and uninsulated sheet-metal and equipment surfaces, supports, damper fittings, access doors, walls, and

similar penetration and construction points shall be sealed with outdoor vapor-barrier coating. Where lengths exceeding 24 inches are involved, insulation shall be flashed with glass-cloth tape and sheet-metal trimming.

Glass-cloth tape shall provide not less than 3 inch overlap, shall be in two layers, and shall be embedded in not less than 1/16 inch dry-film thickness of outdoor vapor-barrier coating. Sheet metal trimming shall be installed after glass-cloth jacket is in place.

Glass-cloth jacketing shall be applied over the insulation outer corner sheet-metal angles and securely cemented in place with nonvapor-barrier adhesive. Corner angles shall be not less than 30-gage galvanized sheet metal with leg dimensions equal to thickness of insulation. Glass cloth embedded in the adhesive shall be pulled tight and wrinkle-free and shall lap seams not less than 4 inches. The entire outer surface shall be given a flood coat of nonvapor-barrier adhesive while the first coat is still wet.

Insulation shall be finished with not less than 6 mils dry-film thickness of nonvapor-barrier coating suitable for painting.

3.2.3 Acoustic Duct-Lining

Fibrous-Glass liner complying with NFPA 255 90A and with NAIMA AH 124. ASTM C1071 with surface exposed to air stream coated to prevent erosion of glass fibers. 1/2-inch thick with K value of 0.26 at 75 deg F. Flame and smoke spread of 25/50 as per ASTM E 84. Liner adhesive shall comply with NFPA 90A or 90B with ASTM C 916.

Mechanical fasteners shall be galvanized steel suitable for adhesive attachment, mechanical attachment or welding attachment to duct without damaging liner

3.3 ACCEPTANCE

Final acceptance will depend upon providing construction (as-built) details to the Contracting Officer. Construction details shall include, by building area, the insulation material type, amount, and installation method. An illustration or map of the duct routing locations may serve this purpose. Data shall have a cover letter/sheet clearly marked with the system name, date, and the words "As built insulation/material - Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database.

3.4 APPLICATION

See drawings for insulation application.

-- End of Section --

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SECTION 15085

PIPING INSULATION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ASTM INTERNATIONAL (ASTM)

ASTM B 209/B 209M	(2004) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 1136	(2000a) Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C 195	(2000) Standard Specification for Mineral Fiber Thermal Insulating Cement
ASTM C 449/C 449M	(2000) Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C 533	(2003) Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
ASTM C 534	(2003) Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C 547	(2003) Standard Specification for Mineral Fiber Preformed Pipe Insulation
ASTM C 795	(2003) Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
ASTM C 916	(1985; R 2000e1) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM C 920	(2002) Standard Specification for Elastomeric Joint Sealants
ASTM C 921	(2003a) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM D 579	(1997) Standard Specification for Greige

Woven Glass Fabrics

- ASTM E 84 (2003) Standard Test Method for Surface Burning Characteristics of Building Materials
- ASTM E 96 (2000e1) Standard Test Methods for Water Vapor Transmission of Materials

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 220 (1999) Standard on Types of Building Construction

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

- SAE AMS 3779 (1990) Tape Adhesive, Pressure Sensitive Thermal Radiation Resistant
- SAE AMS 3779/1A (1990; R 1994) Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Foil/Glass Cloth

1.2 SYSTEM DESCRIPTION

Section 15003, "General Mechanical Provisions," applies to work specified in this section.

1.3 PERFORMANCE REQUIREMENTS

Thermal-insulation system materials shall be noncombustible, as defined by NFPA 220. Adhesives, coatings, sealants, facings, jackets, and thermal-insulation materials, except cellular elastomers, shall have a flame-spread classification (FSC) of 25, and a smoke-developed classification (SDC) of 50. These maximum values shall be determined in accordance with ASTM E 84. Coatings and sealants shall be nonflammable in their wet state.

Adhesives, coatings, and sealants shall have published or certified temperature ratings suitable for the entire range of working temperatures normal for the surfaces to which they are to be applied.

1.4 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Installation Drawings for pipe insulation shall be submitted in accordance with paragraph entitled, "Installation," of this section.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Adhesives
Coatings
Insulating Cement
Insulation Materials
Jacketing
Tape

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either the wet or dry state. Materials to be used on stainless steel surfaces shall meet ASTM C 795 requirements. Materials shall be asbestos free and conform to the following.

2.1.1 Adhesives

2.1.1.1 Cloth Adhesives

Adhesives for adhering, sizing, and finishing lagging cloth, canvas, and open-weave glass cloth shall be a pigmented polyvinyl acetate emulsion and shall conform to the requirements of ASTM C 916, Type I.

2.1.1.2 Vapor-Barrier Material Adhesives

Adhesives for attaching laps of vapor-barrier materials and presized glass cloth and for attaching insulation to itself, to metal, and to various other substrates, shall be solvent-base, synthetic-rubber type and shall conform to the requirements of ASTM C 916, Type I, for attaching fibrous-glass insulation to metal surfaces. Solvent shall be nonflammable.

2.1.1.3 Cellular Elastomer Insulation Adhesive

Adhesive for cellular elastomer insulation shall be a solvent cutback chloroprene elastomer conforming to ASTM C 916, Type I, and shall be of a type approved by the manufacturer of the cellular elastomer for the intended use.

2.1.2 Coatings

2.1.2.1 Outdoor Vapor-Barrier Finishing

Coatings for outdoor vapor-barrier finishing of insulation surfaces such as fittings and elbows shall be a nonasphaltic, hydrocarbon polymer, solvent-base mastic containing a blend of nonflammable solvents. Coatings shall conform to the requirements of ASTM C 1136 and ASTM C 921.

2.1.2.2 Indoor Vapor-Barrier Finishing

Coatings for indoor vapor-barrier finishing of insulation surfaces shall be a pigmented resin and solvent compound and shall conform to ASTM C 1136, Type II.

2.1.2.3 Outdoor and Indoor Nonvapor-Barrier Finishing

Coatings for outdoor and indoor nonvapor-barrier finishing of insulation surfaces shall be pigmented polymer-emulsion type recommended by the insulation material manufacturer for the surface to be coated and shall be applied to specified dry-film thickness.

2.1.2.4 Cellular-Elastomer Insulation Coating

Finish coating for cellular-elastomer insulation shall be a polyvinylchloride lacquer approved by the manufacturer of the cellular elastomer.

2.1.2.5 Coating Color

Coating color shall be white.

2.1.3 Insulating Cement

2.1.3.1 General Purpose Insulating Cement

General purpose insulating cement shall be [diatomaceous silica] [mineral fiber] and shall conform to ASTM C 195. Composite shall be rated for 1800 degrees F service and shall have a thermal-conductivity maximum of 0.85 Btu by inch per hour per square foot for each degree F temperature differential at 200 degrees F mean temperature for 1 inch thickness.

2.1.3.2 Finishing Insulating Cement

Finishing insulating cement shall be mineral-fiber, hydraulic-setting type conforming to ASTM C 449/C 449M.

2.1.4 Calking

Calking used with specified insulation materials shall be an elastomeric joint sealant in accordance with ASTM C 920, Type S, Grade NS, Class 25, Use A.

2.1.5 Corner Angles

Corner angle piping insulation shall be nominal 0.016 inch aluminum 1 by 1 inch with factory applied kraft backing. Aluminum shall be in accordance with ASTM B 209/B 209M, Alloy 3003.

2.1.6 Insulation Materials

Insulation conductances shall be maximum values, as tested at any point, not an average. Insulation conductance found by test to exceed the specified maximum shall either be replaced or augmented by an additional

thickness to bring it to the required maximum conductance and a complete finishing system.

2.1.6.1 Mineral Fiber

Mineral fiber shall conform to ASTM C 547, shall be suitable for surface temperatures up to 370 degrees F, and shall be of not less than 4-pound per cubic foot density. Thermal conductivity shall be not greater than 0.26 Btu per hour per square foot square per degree F at 150 degrees F mean.

2.1.6.2 Pipe Barrel

Pipe barrel insulation shall be Type II, Molded, Grade A or Type III, Precision V-Groove, Grade A for use at temperatures up to and including 1200 degrees F.

2.1.6.3 Pipe Fittings

Pipe fitting insulation shall be molded pipe fitting covering for use at temperatures up to and including 1200 degrees F.

2.1.6.4 Flexible Blankets

Flexible blankets shall be blankets and felts for use at temperatures up to and including 350 degrees F minimum 1 pound per cubic foot density. Thermal conductivity shall be not greater than 0.26 Btu per hour per square foot per degree F at 75 degrees F mean.

2.1.6.5 Rigid Board

Semi-rigid board shall be ASTM C 612, Class 2, jacketed board. Thermal conductivity of 0.23 Btu per hour per square foot per degree F at 75 degrees F means. Density of 3.0 pound per cubic foot.

2.1.6.6 Cellular Elastomer

Cellular elastomer shall conform to ASTM C 534, except that the water-vapor permeability shall not exceed 0.30 perms per foot per inch per hour per square foot mercury pressure difference for 1 inch thickness.

2.1.6.7 Calcium Silicate

Calcium silicate shall conform to ASTM C 533. Apparent thermal conductivity shall be not greater than 0.54 Btu-inch per hour per square foot per degree F at 200 degrees F mean.

2.1.7 Jacketing

2.1.7.1 Aluminum Jackets

Aluminum sheet shall be in accordance with ASTM B 209/B 209M and shall be 0.016 inch thick with factory-applied vapor barrier on the insulation side.

Aluminum shall be made from smooth, polished, Temper H14, Alloy 3003. Straps shall be AISI 300 series corrosion-resistant steel, 15 mils thick,

1/2 inch wide, for pipe under 12 inch diameter and 3/4 inch wide for pipe over 12 inch diameter.

Elbow jackets shall be 0.016 inch thick, deep-drawn, die-shaped, two-piece components for long-radius, butt-weld elbows manufactured from the same materials as specified for jackets, with factory-attached vapor-seals on underside of the aluminum. Preinsulated, voidless, jacketed components conforming to these specifications shall be used. Preinsulated fittings shall have a 2 inch overlay beyond route for weld bead.

Vapor barrier shall be 60 pound per 100 square foot kraft paper with 10 pound per 100 square foot polyethylene coating.

Pipe jackets shall have not less than 2 inch longitudinal and circumferential lap.

Sealant for longitudinal and butt joints of aluminum jacketing shall be an aluminum-pigmented, butyl, polymer sealant with high-butyl solids.

2.1.7.2 Glass Cloth Jackets

Glass cloth shall be plain-weave glass cloth conforming to ASTM D 579, Style 141 and shall weigh not less than 7.23 ounces per square yard before sizing. Cloth shall be factory applied wherever possible.

Glass reinforcing cloth shall be a leno weave, 26-end and 12-pick thread conservation, with a warp and fill tensile strength of 45 and 30 pounds per inch of width, respectively, and with a weight of not less than 1.5 ounces per square yard. At the Contractor's option, Style 191 leno-weave glass cloth conforming to ASTM D 579 may be provided.

2.1.7.3 PVC Jackets

Polyvinylchloride (PVC) shall be a 0.010 inch thick, factory-premolded, one-piece fitting. Material shall be self-extinguishing, high-impact strength, moderate chemical resistance. Permeability rating shall be 0.01 grain per hour per square foot per inch of mercury pressure difference, determined in accordance with ASTM E 96. Vapor-barrier joint adhesive shall be the manufacturer's standard solvent-weld type.

Vapor barrier shall conform to ASTM C 1136, Type I, low-vapor transmission, high-puncture resistance for use on insulation for piping, ducts, and equipment.

2.1.7.4 3-Ply Laminate

Jacketing shall be a 3-ply laminate of 35-pound per 100 square foot white-bleached kraft, bonded to not less than 0.0007 inch thick aluminum foil and reinforced with glass fiber.

Water-vapor permeance rating of the composite shall be 0.02 perm or grain per hour per square foot, per inch of mercury pressure differential, determined in accordance with ASTM E 96.

2.1.8 Tape

Glass lagging shall be a knitted elastic cloth specifically suitable for continuous spiral wrapping of insulated pipe bends and fittings and shall produce a smooth, tight, wrinkle-free surface. Tape shall conform to requirements of SAE AMS 3779, SAE AMS 3779/1A, ASTM D 579, and ASTM C 921, and shall weigh not less than 10 ounces per square yard.

2.2 PIPING SYSTEMS

Insulation thickness and pipe sizes are in inches. Pipe size is inclusive dimensionally, and includes pipe nominal pipe size (NPS) and tubing outside diameter.

2.2.1 Domestic Hot-Water and Hot Water Circulating

Insulation shall be mineral fiber with glass cloth jacket, Type T-2. Thickness shall be not less than that given in the following list. Aboveground pipes, valve bodies, fittings, unions, flanges, and miscellaneous surfaces shall be insulated.

PIPE SIZE (INCH)	INSULATION THICKNESS (INCH)
Up to 4	1
4 to 10	1-1/2
10 to 12	2

2.2.2 Low Temperature Heating Water

Insulation shall be mineral fiber with glass cloth jacket, Type T-2. Thickness shall be not less than that given in the following list. Aboveground pipes, valve bodies, fittings, unions, flanges, and miscellaneous surfaces shall be insulated.

PIPE SIZE (INCH)	INSULATION THICKNESS (INCH)
All	1-1/2

2.2.3 Cold-Water and Condensate-Drain Piping

Aboveground pipes, valve bodies, fittings, unions, flanges, and miscellaneous surfaces shall be insulated

Insulation shall be 1/2 inch mineral fiber with glass cloth jacket, Type T-2.

2.2.4 Refrigerant Suction Piping

Insulation shall be cellular-elastomer, Type T-3. Thickness shall be

nominal 3/4 inch. Surfaces, including valve, fittings, unions, and flanges, shall be insulated.

2.2.5 High-Temperature Heating Lines 450 degrees F

Insulation shall be calcium silicate with glass cloth jacket, Type T-5. Thickness shall be not less than indicated in following list which is based on an 80 degrees F ambient temperature in still air with an insulation "K" factor of 0.37 at 200 degrees F mean temperature:

PIPE SIZE (INCH)	INSULATION THICKNESS (INCH)
Up to 1-1/2	3-1/2
1-1/2 to 4	4

2.2.6 Hot Water Heating Convertor

Insulation shall be calcium silicate with glass cloth jacket, Type T-7. Thickness shall be 1-1/2 inches.

2.2.7 High Temperature heating Water, Weather-Exposed, 450 degrees F

Insulation shall be calcium silicate with weatherproof jacket, Type T-17. Thickness shall be not less than that indicated in the following list. All system surfaces shall be insulated.

PIPE SIZE (INCH)	INSULATION THICKNESS (INCH)
Up to 1-1/2	3-1/2
1-1/2 to 4	4

2.2.8 Air Separator

insulation shall be semi-rigid board, 1-inch thick with glass cloth jacket.

PART 3 EXECUTION

3.1 INSTALLATION OF INSULATION SYSTEMS

Contours on exposed work shall be smooth and continuous. Cemented laps, flaps, bands, and tapes shall be smoothly and securely pasted down. Adhesives shall be applied on a full-coverage basis.

Insulation shall be applied only to system or component surfaces that have been tested and approved.

Joints shall be tight with insulation lengths tightly butted against each other. Where lengths are cut, cuts shall be smooth and square and without

breakage of end surfaces. Where insulation terminates, ends shall be neatly tapered and effectively sealed, or finished as specified. Longitudinal seams of exposed insulation shall be directed away from normal view.

Materials shall be applied in conformance with the recommendations of the manufacturer.

Surfaces shall be clean and free of oil and grease before insulation adhesives or mastics are applied. Solvent cleaning required to bring metal surfaces to such condition shall be provided.

Installation Drawings for pipe insulation shall be in accordance with the adhesive manufacturer's written instructions for installation.

3.2 SYSTEM TYPES

3.2.1 Type T-1, Mineral Fiber with Vapor-Barrier Jacket

Piping shall be covered with mineral-fiber pipe insulation with factory-and field-attached vapor-barrier jacket. Vapor seal shall be maintained. Jackets, jacket laps, flaps, and bands shall be securely cemented in place with vapor-barrier adhesive. Jacket overlap shall be not less than 1-1/2 inches. Jacketing bands for butt joints shall be 3 inches wide.

Exposed-to-view fittings and valve bodies shall be covered with preformed mineral-fiber pipe-fitting insulation of the same thickness as the pipe-barrel insulation. Fitting insulation shall be temporarily secured in place with light cord ties. A 60-mil coating of white indoor vapor-barrier coating shall be applied and, while still wet, wrapped with glass lagging tape with 50 percent overlap, and shall be smoothly blended into the adjacent jacketing. Additional coating shall be applied as needed and rubber-gloved to smooth fillet or contour coating, then allowed to fully cure before the finish coating is applied. On-the-job fabricated insulation for concealed fittings and special configurations shall be built up from mineral fiber and a special mastic consisting of a mixture of insulating cement and lagging adhesive diluted with 3 parts water. Where standard vapor-barrier jacketing cannot be used, the surfaces shall be made vapor tight by using coating and glass lagging cloth or tape as previously specified.

In lieu of materials and methods previously specified, fittings may be wrapped with a twine-secured, mineral-wool blanket to the required thickness and covered with premolded polyvinylchloride jackets. Seams shall be made vapor tight with a double bead of manufacturer's standard vapor-barrier adhesive applied in accordance with the manufacturer's instructions. All jacket ends shall be held in place with AISI 300 series corrosion-resistant steel straps, 15 mils thick by 1/2 inch wide.

Pipe insulation shall be set into an outdoor vapor-barrier coating for a minimum of 6 inches at maximum 12-foot spacing and the ends of the insulation sealed to the jacketing with the same material to provide an effective vapor-barrier stop.

Staples shall not be used in applying insulation. Vapor-barrier materials shall be continuous over all surfaces, including areas inside pipe sleeves, hangers, and other concealments.

Piping insulation at hangers shall consist of 13-pounds per cubic foot density, fibrous-glass inserts or expanded, rigid, closed-cell, polyvinylchloride. Junctions shall be sealed with vapor-barrier jacket where required, glass-cloth mesh tape, and vapor-barrier coating.

White-bleached kraft paper side of the jacketing shall be on the side exposed to view.

Exposed-to-view insulation shall be finished with not less than a 6-mil dry-film thickness of nonvapor-barrier coating suitable for painting.

3.2.2 Type T-2, Mineral Fiber with Glass Cloth Jacket

Piping shall be covered with a mineral-fiber, pipe insulation with factory-attached, presized, white, glass cloth. Jackets, jacket laps, flaps, and bands shall be securely cemented in place with vapor-barrier adhesive. Jacket overlap shall be not less than 1-1/2 inches. Jacketing bands for butt joints shall be 3 inches wide.

Exposed-to-view fittings shall be covered with preformed mineral-fiber fitting insulation of the same thickness as the pipe insulation and temporarily secured in place with light cord ties. Impregnated glass lagging tape shall be installed with indoor vapor-barrier on 50 percent overlap basis and the tape shall be blended smoothly into the adjacent jacketing. Additional coating shall be applied as needed, and rubber gloved to a smooth contour. Ends of insulation shall be taped to the pipe at valves 2 inches and smaller. On-the-job fabricated insulation for concealed fittings and special configurations shall be built up from mineral fiber and a mixture of insulating cement and lagging adhesive, diluted with 3 parts water. Surfaces shall be finished with glass cloth or tape lagging.

Valves 2-1/2 inches and larger and all flanges shall be covered with preformed insulation of the same thickness as the adjacent insulation.

Exposed-to-view insulation shall be finished with a minimum 6-mil dry-film thickness of nonvapor-barrier coating suitable for painting.

3.2.3 Type T-3, Cellular Elastomer

Piping-system surfaces shall be covered with flexible cellular-elastomer sheet or preformed insulation. Vapor seal shall be maintained. Insulation shall be cemented into continuous material with a solvent cutback chloroprene adhesive recommended by the manufacturer for the specific purpose. Adhesive shall be applied to both of the surfaces on a 100-percent coverage basis to a minimum thickness of 10 mils wet or approximately 150 square feet per gallon of undiluted adhesive.

At pipe hangers or supports where the insulation rests on the pipe hanger strap, the insulation shall be cut with a brass cork borer and a No. 3

superior grade cork inserted. Seams shall be sealed with approved adhesive. Sweat fitting shall be insulated with miter-cut pieces of cellular elastomer insulation of the same nominal pipe size and thickness as the insulation on the adjacent piping or tubing. Miter-cut pieces shall be joined with approved adhesive. Covers shall be slit and snapped over the fitting, and joints shall be sealed with approved adhesive.

Screwed fittings shall be insulated with sleeve-type covers formed from miter-cut pieces of cellular elastomer thermal insulation having an inside diameter large enough to overlap adjacent pipe insulation. Pipe insulation shall be butted against fittings. Overlap shall be not less than 1 inch. Adhesive shall be used to join cover pieces and cement the cover to the pipe insulation.

Surfaces exposed to view or ultraviolet light shall be finished with a 2-mil minimum dry-film thickness application of a polyvinylchloride lacquer recommended by the manufacturer, and applied in not less than two coats.

3.2.4 Type T-6, Mineral Fiber with Aluminum Jacket

Piping shall be covered with mineral-fiber pipe insulation with factory-attached or field-applied aluminum jacketing.

Fittings and valve bodies shall be covered with preformed mineral-fiber pipe-fitting insulation of the same thickness as the pipe-barrel insulation. Fitting insulation shall be secured temporarily in place with light cord ties. A 60-mil coating of vapor-barrier mastic shall be applied, and while still tacky, wrapped with glass lagging tape.

Additional mastic shall be applied as needed and rubber-gloved to smooth fillets or contours. On-the-job fabricated insulation for special configurations shall be built up from mineral fiber and a mixture of insulating cement and lagging adhesive diluted with 3 parts water. Only where standard aluminum jacketing cannot be used, the surfaces shall be made vapor-tight by using mastic and glass lagging cloth or tape as specified above with an added finish coat of mastic.

Pipe insulation shall be set into outdoor vapor-barrier coating for a minimum of 6 inches at maximum 12-foot spacing. Ends of the insulation shall be sealed to the jacketing with the same material to provide effective vapor barrier stops.

Vapor barrier shall be continuous over all surfaces, including areas inside pipe sleeves, hangers, and other concealment.

Piping insulation shall be applied to both sides of pipe hangers. Junctions shall be insulated with a special mastic mixture, glass cloth mesh tape, and mastic as previously specified.

Jacket laps, flaps, and bands shall be securely cemented in place with aluminum jacket sealant. Jacketing bands for butt joints shall be 6 inches wide.

Joints, wherever possible, shall be lapped against the weather so that the

water will run off the lower edge. Laps shall be in accordance with the pipe drainage pitch. Longitudinal laps on horizontal lines shall be located 45 degrees below the horizontal centerline and alternately staggered 1 inch. Jacketing material shall be lapped a minimum of 2 inches, circumferentially sealed with mastic, and strapped to provide a waterproof covering throughout. Straps shall be located 8 inches on center and shall be pulled up tight to hold jacketing securely in place. Screws shall be used in addition to straps when necessary to obtain a waterproof covering. Extra straps shall be placed on each side of supporting devices and at openings. Where flanging access occurs, a chamfer sheet shall be strapped to the pipe at jacketing.

Exposed longitudinal edges of aluminum jacketing shall be stiffened by bending a 1 inch hem on one edge.

Expansion joints shall provide for maximum and minimum dimensional fluctuations.

To prevent corrosion, the aluminum jacketing shall not come in direct contact with other types of metal.

At openings in jacket, an outdoor vapor-barrier coating shall be applied for 2 inches in all directions. Jacketing shall be applied while waterproofing is tacky.

Screws shall be used at each corner of each sheet, at fitting jackets, and as necessary for the service. Number 7, 3/8 inch long, binding-head aluminum sheet metal screws shall be placed through the mastic seal.

3.2.5 Type T-7, Calcium Silicate with Glass Cloth Jacket (Surfaces)

Surfaces shall be covered with insulation block bedded in an insulating cement and covered with glass cloth jacketing.

Surfaces shall be cleaned with a chlorinated solvent. General purpose insulating cement shall be mixed with 3 parts water to 1 part nonvapor-barrier adhesive to bring to application consistency. Block shall be set into bedding and joints and spaces shall be filled with a bedding mix and wrapped with galvanized chicken wire mesh well laced into an envelope. A 3/8 inch thick coating of bedding mix jacket shall be troweled on with nonvapor-barrier adhesive and glass cloth. Surfaces shall be finished with not less than a 6-mil dry-film thickness of nonvapor-barrier coating.

3.2.6 Type T-9, Cellular Elastomer

Pump surfaces shall be solvent cleaned. Not less than 1 inch of general purpose insulating cement shall be applied, mixed with nonvapor-barrier adhesive diluted with 3 parts water, to achieve smooth surface and configuration contours. After all water has been removed, surfaces shall be covered with 1/2 inch thick cellular elastomer insulation attached and joined into a continuous sheet with an outdoor vapor-barrier coating recommended by the insulation manufacturer for the specific purpose. Coating shall be applied to both of the surfaces on a 100-percent coverage

basis with a minimum thickness of 10 mils wet, or approximately 150 square feet per gallon of undiluted coating. Coating shall be blended into the adjacent flange insulation and the joint covered with a band of cellular elastomer equal to the flange assembly width. Same coating shall be used to seal insulation to the casing at penetrations and terminations. Pumps shall be insulated in a manner that will permit insulation to be removed to repair or replace pumps.

Insulation shall be finished with a 2-mil minimum dry-film application of a polyvinylchloride lacquer coating recommended by the manufacturer and applied in not less than two coats.

3.2.7 Type T-10, Mineral-Fiber Fill

Voids surrounding pipe shall be packed with mineral-fiber fill.

3.3 ACCEPTANCE

Final acceptance will depend upon providing construction (as-built) details to the Contracting Officer. Construction details shall include, by building area, the insulation material type, amount, and installation method. An illustration or map of the duct routing locations may serve this purpose. Data shall have a cover letter/sheet clearly marked with the system name, date, and the words "As built insulation/material - Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database.

-- End of Section --

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SECTION 15102

PLUMBING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C651 (1999) Disinfecting Water Mains

ASME INTERNATIONAL (ASME)

ASME B1.20.7 (1991; R 1998) Hose Coupling Screw Threads
(Inch)

ASME B16.26 (1988) Cast Copper Alloy Fittings for
Flared Copper Tubes

ASTM INTERNATIONAL (ASTM)

ASTM B 88 (1999) Standard Specification for Seamless
Copper Water Tube

INTERNATIONAL CODE COUNCIL (ICC)

ICC IPC (2000) International Plumbing Code

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-58 (2002) Pipe Hangers and Supports -
Materials, Design and Manufacture

MSS SP-69 (1996) Pipe Hangers and Supports -
Selection and Application

MSS SP-80 (1997) Bronze Gate, Globe, Angle and Check
Valves

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI WH 201 (1983) Water Hammer Arrestors Standard

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS FF-S-325 (Int Amd 3) Shield, Expansion; Nail,
Expansion; and Nail, Drive Screw (Devices,
Anchoring, Masonry)

1.2 DESIGN REQUIREMENTS

Section 15003 GENERAL MECHANICAL PROVISIONS applies to work specified in this section.

Plumbing systems shall be provided and shall include the water supply system, the waste and vent system, and all required plumbing fixtures and fittings. Plumbing fixtures and fittings shall be selected in accordance with the water conservation guidelines as described in ICC IPC, Table 604.4.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

SD-02 Shop Drawings

Detail Drawings shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

Installation Drawings shall be submitted for piping systems in accordance with paragraph entitled, "Pipe Installation," of this section.

SD-03 Product Data

Equipment and Performance Data shall be submitted for storage-type water heaters consisting of storage capacity and energy efficiency.

SD-06 Test Reports

Test Reports shall be submitted for hydrostatic pressure tests in accordance with paragraph entitled, "Tests," of this section.

1.4 GENERAL REQUIREMENTS

Detail Drawings shall be submitted for plumbing systems.

Material, Equipment, and Fixture Lists shall be submitted for plumbing systems.

PART 2 PRODUCTS

2.1 WATER SUPPLY SYSTEM COMPONENTS

2.1.1 Pipe and Fittings

2.1.1.1 Copper Pipe

Above ground copper tubing shall conform to ASTM B 88, Type L, hard-drawn for horizontal and vertical exposed and concealed lines.

Underground copper tubing shall conform to ASTM B 88, Type K, seamless. No joints shall be permitted in underground copper piping unless specifically approved. Fittings for connection to corporation cocks shall be cast bronze, flared type, conforming to ASME B16.26. Underground joints shall be brazed.

Fittings and unions shall be 150 pounds per square inch gage (psig) working steam pressure (wsp), wrought-copper solder joint conforming to ASME B16.22.

Solder shall be 95-5 tin-antimony, alloy Sb5, conforming to AWS WHB-2.8. Brazing rod shall be classification BCP-5, conforming to AWS A5.8.

Copper tubing systems may be installed using mechanical pipe couplings of a bolted type with a central cavity design pressure responsive gasket. Copper pipe and fittings are to be grooved in accordance with the coupling manufacturers specifications.

2.1.2 Valves and Specialties

2.1.2.1 Gate Valves

Valves shall be designed for a minimum of 150 psi. Valves shall have screw joints. Valves smaller than 3 inches shall be all brass and shall conform to MSS SP-80, Type I. Valves 3 inches and larger shall be iron-body, brass-mounted, conforming to AWWA C500.

2.1.2.2 Hose Faucets

Hose faucets shall be constructed with 1/2-inch male inlet threads, hexagon shoulder, and 3/4-inch hose connection, conforming to ANSI A112.18.1M. Hose-coupling screw threads shall conform to ASME B1.20.7.

Vandalproof, atmospheric-type vacuum breaker shall be provided on discharge.

2.1.2.3 Service Stops

Service stops shall be waterworks ground-key type, oval flowway, T-handle, without drain. Pipe connections shall be suitable for the type of service pipe used. Parts shall be cast red brass having a nominal composition of 85 percent copper, 5 percent tin, 5 percent lead, and 5 percent zinc, with female ips connections designed for a minimum pressure of 200 psi.

2.1.2.4 Water-Hammer Arresters

Water-hammer arresters shall be commercially manufactured products consisting of bellows arranged to absorb the energy of pressure waves generated by valve closure in a line in which water is flowing. Arresters shall be nonferrous construction, shall be rated as to capacity, and shall

be certified in accordance with PDI WH 201.

2.1.2.5 Wall Hydrants

Wall hydrants shall have brass wall-boxes with nozzles, detachable T-handles, freeze proof valve and shall be provided with vandalproof type BAT vacuum breakers. Exterior surfaces shall be chrome-plated.

2.1.2.6 Sill Cock

Sill cocks shall have brass wall - boxes with nozzle, detachable T-handles, and provided with vandalproof type BAT vacuum breakers. Exterior surfaces shall be chrome plated.

2.2 SANITARY DRAIN, WASTE, AND VENT SYSTEM (DWV)

2.2.1 DWV Piping

2.2.1.1 PVC Pipe and Fittings

Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

2.3 SUPPORTING ELEMENTS

Necessary piping-system components and miscellaneous supporting elements shall be provided, including, but not limited to, building structure attachments; supplementary steel; hanger rods, stanchions, and fixtures; vertical pipe attachments; horizontal pipe attachments; anchors; and variable and constant supports. Supporting elements shall be suitable for stresses imposed by systems pressures and temperatures, and natural and other external forces.

Supporting elements shall be in accordance with FM P7825 and be UL listed and shall conform to ASME B31.1, MSS SP-58, MSS SP-69, and requirements specified herein.

Types of devices specified herein are defined in referenced MSS standards.

2.3.1 Building Structure Attachments

2.3.1.1 Anchor Devices, Concrete and Masonry

Anchor devices shall conform to requirements of FS FF-S-325, Group I; Group II, Type 2, Class 2, Styles 1, 2; Group III; Group VIII, as appropriate for the building structure.

Anchor devices for cast-in floor-mounted equipment shall provide for adjustable positions.

Powder-actuated anchoring devices shall not be used to support any mechanical-system components.

2.3.1.2 Beam Clamps

Beam clamps shall be center-loading MSS SP-58 Types D21, 28, 29, and 30, UL listed, cataloged and load-rated, commercially manufactured products.

2.3.1.3 C-Clamps

C-clamps shall be used to support piping sizes 1-1/2 inches and smaller. C-clamps shall be FM P7825 approved and UL listed with hardened cup tip, setscrew, locknut, and retaining strap. Retaining-strap section shall be not less than 1/8 inch Beam-flange thickness to which clamps are attached shall not exceed 0.60 inch.

2.3.2 Horizontal Pipe Attachments

2.3.2.1 Single Pipes

Piping in sizes through 2-inch ips shall be supported by MSS SP-58 Type 6 solid malleable-iron pipe rings, except that split-band rings shall be used in sizes up to 1-inch ips.

Piping in sizes through 8-inch ips inclusive shall be supported by MSS SP-58 Type 1, 3, or 4 attachments.

MSS SP-58 Type 1 and 6 assemblies shall be used on vapor-sealed insulated piping and shall have an inside diameter 1-ips larger than the pipe being supported, to provide adequate clearance during pipe movement.

MSS SP-58 Type 12 devices with double-bolted, angle-iron wall or fixture clips shall be used in pipe chases to support fixture-supply piping.

MSS SP-58 Type 40 shields shall be used on insulated piping. Area of the supporting surface shall be such that compression deformation of insulated surfaces does not occur. Longitudinal and transverse shield edges shall be rolled away from the insulation.

2.3.2.2 Parallel Pipes

Trapeze hangers fabricated from, structural-steel shapes, with U-bolts shall be used in congested areas and where multiple pipe runs occur. Structural-steel shapes and structural supports shall be a commercially available, of a preengineered design, rolled steel.

2.3.3 Vertical Single Pipe Attachments

Vertical pipe attachments shall be MSS SP-58 Type 8.

2.3.4 Hanger Rods

Only circular cross-section rod hangers shall be used to connect building-structure attachments to pipe supports. Pipe, straps, or bars of equivalent strength shall be used for hangers only where approved by the Contracting Officer.

2.3.5 Copper Tubing and Pipe Supports

Metal surfaces in contact with copper tubing or pipe shall be plastic-coated.

Support surfaces shall have large contact areas to prevent point loading with consequent cutting. Minimum direct-contact areas shall be equal to commercially available Type I hangers.

2.4 MISCELLANEOUS MATERIALS

2.4.1 Escutcheons

Escutcheons shall be manufactured from nonferrous metals and shall be chrome-plated except when AISI 300 series corrosion-resistant steel is provided. Metals and finish shall conform to ANSI A112.19.1M, ANSI A112.19.2M, and ANSI A112.19.3M.

Escutcheons shall be one-piece type where mounted on chrome-plated pipe or tubing, and one-piece of split-pattern type elsewhere. Escutcheons shall have provisions consisting of internal spring-tension devices or setscrews for maintaining a fixed position against a surface.

PART 3 EXECUTION

3.1 PIPE INSTALLATION

Installation drawings shall be submitted and piping systems shall be fabricated and installed in accordance with ASME B31.1 and MSS SP-69.

Final connections to equipment shall be made with unions or flanges. A union or flange shall be provided every 100 feet of straight run. Unions shall be provided in the line downstream of screwed- and welded-end valves.

Metallic pipe ends shall be reamed before joint connections are made.

Pipe ends shall be reamed before joint connections are made.

Connections between copper and steel pipe or equipment shall be made using dielectric unions having 175-psi minimum pressure.

Cutting of metallic piping shall be by wheel cutters or other machines designed specifically for that purpose. Electric-arc and oxyacetylene cutting shall not be permitted.

Screwed unions, welded unions, or bolted flanges shall be provided wherever required to permit convenient removal of equipment, valves, and piping accessories from the piping system for maintenance.

Piping systems shall be securely supported with due allowance for thrust forces and thermal expansion and contraction, and shall not be subjected to mechanical, chemical, vibration, or other damage as specified in ASME B31.1.

3.2 VALVES

Valves shall be provided in piping mains, on branches, and at equipment locations.

Valves shall be provided to permit isolation of branch piping and each equipment item from the balance of the system.

Riser and downcomer drains above piping shutoff valves in piping 2-1/2 inches and larger shall be provided. Shutoff valve body shall be tapped and fitted with a 1/2-inch plugged globe valve.

Valves unavoidably located in furred or other normally inaccessible places shall be provided with adequately sized access panels approved for the location.

3.3 SUPPORTING ELEMENTS INSTALLATION

Supporting elements shall be provided as indicated.

Piping shall be supported from building structure only. Piping shall not be supported from roof deck or from other pipe.

Piping shall run parallel with the lines of the building. Piping and components shall be spaced and installed so that a threaded pipe fitting may be removed between adjacent pipes and so that there shall be no less than 1/2 inch of clear space between the finished surface and other work and between the finished surface of parallel adjacent piping. Hangers on different adjacent service lines running parallel with each other shall be arranged to be in line with each other and parallel to the lines of the building.

Piping support elements shall be installed at intervals not more than 3 feet from the ends of each runout, and not over 1 foot from each change in direction of piping.

Load rating for pipe-hanger supports shall be based on insulated weight of lines filled with water and forces imposed. Deflection per span shall not exceed slope gradient of pipe. Supports shall be in accordance with the following minimum rod size and maximum allowable hanger spacing for specified pipe. For concentrated loads such as valves, the allowable span shall be reduced proportionately:

PIPE SIZE <u>INCHES</u>	ROD SIZE <u>INCHES</u>	STEEL PIPE <u>FEET</u>	COPPER PIPE <u>FEET</u>
1 and smaller	3/8	8	6
1-1/4 to 1-1/2	3/8	10	8
2	3/8	12	10
2-1/2 to 3-1/2	1/2	12	12

PIPE SIZE <u>INCHES</u>	ROD SIZE <u>INCHES</u>	STEEL PIPE <u>FEET</u>	COPPER PIPE <u>FEET</u>
4 to 5	5/8	12	12
6	3/4	12	12

3.4 SLEEVES

Sleeves shall be provided where piping passes through roofs, masonry or concrete walls, and floors.

Sleeves passing through steel decks shall be continuously welded or brazed to the deck.

Sleeves that extend through floors, roofs, load bearing walls, and fire barriers shall be continuous and fabricated from Schedule 40 steel pipe, with welded anchor lugs. Other sleeves shall be formed by molded linear polyethylene liners or similar materials which are removable. Diameter of sleeves shall be large enough to accommodate pipe, insulation, and jacketing without touching the sleeve and shall provide a minimum 3/8 inch clearance. Sleeve size shall accommodate mechanical and thermal motion of pipe to preclude transmission of vibration to walls and the generation of noise.

Space between a pipe, bare or insulated, and the inside of a pipe sleeve or a construction surface penetration shall be packed solid with a mineral fiber conforming to ASTM C 592. This packing shall be provided wherever the piping passes through firewalls, equipment room walls, floors, and ceilings connected to occupied spaces, and other locations where sleeves or construction-surface penetrations occur between occupied spaces. Where sleeves or construction surface penetrations occur between conditioned and unconditioned spaces, the space between a pipe, bare or insulated, and the inside of a pipe sleeve or construction surface penetration shall be filled with an elastomer calk to a depth of 1/2 inch. Surfaces to be calked shall be oil-and grease-free.

Sleeve height above roof surface shall account for roof flooding conditions and shall be a minimum of 12 inches and a maximum of 18 inches.

3.5 ESCUTCHEONS

Escutcheons shall be provided at penetrations of piping into finished areas. Where finished areas are separated by partitions through which piping passes, escutcheons shall be provided on both sides of the partition. Where suspended ceilings are installed, plates shall be provided at the underside only of such ceilings. For insulated pipes, the plates shall be large enough to fit around the insulation. Escutcheons shall be chrome-plated in occupied spaces and of size sufficient to effectively conceal openings in building construction. Escutcheons shall be firmly attached with setscrews.

3.6 FLASHINGS

Flashings shall be provided at penetrations of building boundaries by mechanical systems and related work.

3.7 TESTS

Test reports shall be submitted in accordance with referenced standards in this section.

Plumbing systems shall be tested to prove tightness of piping and connections and proper operation of equipment and fixtures.

Hydrostatic tests shall be performed by completely filling the piping system with water and eliminating accumulation of air so that any leakage will be immediately apparent. Pressure shall be maintained until pipe under test has been examined, but in no case for less than 1 hour.

Hot- and cold-water piping shall be hydrostatically tested at 1.5 times the design pressure under 125 psi pressure for not less than 8 hours with no loss of pressure. Leaks shall be eliminated by replacing the pipe or fitting in question at no additional cost to the Government. Underground hot- and cold-water piping shall be tested before backfilling.

Drainage and venting piping shall be tested before the fixtures are installed. Underground soil and waste piping shall be tested before backfilling. Testing shall be applied to the system in its entirety.

When the entire system is tested, openings in the pipes shall be tightly closed except the highest opening, and the system shall be filled with water to the point of overflow.

When the system is tested, each opening except the highest opening of the section under test shall be tightly plugged, and filled with water and tested with at least a 10-foot head of water. Water shall be kept in the system or in the portion under test for at least 2 hours before the inspection starts. System shall be proved tight at all joints.

3.8 DISINFECTION

Water piping, including valves, fittings, and other devices, shall be disinfected with a solution of chlorine and water, and tested according to AWWA C651. Solution shall contain not less than 50 parts per million (ppm) of available chlorine. Solution shall be held for a period of not less than 8 hours, after which time the solution shall contain not less than 10 ppm of available chlorine or the piping shall be disinfected again. After successful disinfection, the piping shall be flushed before placing into service. Water for disinfection will be furnished by the Government, but disposal shall be the responsibility of the Contractor.

3.9 PLUMBING FIXTURES

Materials, equipment, and fixtures shall be installed in accordance with the manufacturer's recommendations. Fixtures and equipment shall be installed to comply with ICC IPC for water conservation.

Fixtures shall be clean and free of deleterious material before being installed. Before connecting to water, waste, vent, or trap service, the fixture lines shall be blown out with compressed air. During the progress of construction, open ends of fixtures shall be protected at all times to prevent the admission of foreign matter.

-- End of Section --

SECTION 15107

PLASTIC PIPE AND FITTINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ASTM INTERNATIONAL (ASTM)

ASTM D 1784	(2003) Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
ASTM D 2665	(2003) Standard Specification for Poly (Vinyl Chloride) (PVC), Plastic Pipe, Schedule 40
ASTM D 3311	(2002) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2564	(2002) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2855	(1996; R 2002) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings

1.2 GENERAL REQUIREMENTS

Section 15003 GENERAL MECHANICAL PROVISIONS applies to work specified in this section.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-03 Product Data

Manufacturer's Catalog Data shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

SD-07 Certificates

Certificates shall be submitted for Potable Water Systems Materials in accordance with paragraph entitled, "General Requirements," of this section.

Seal of approval of [National Sanitation Foundation testing laboratory] [approved testing laboratory acceptable to public health officials] for .

1.4 GENERAL REQUIREMENTS

Manufacturer's Catalog Data shall be submitted for plastic pipe and fittings, for each size and type.

PART 2 PRODUCTS

2.1 POLYVINYLCHLORIDE (PVC) PIPE

PVC pipe shall be in accordance with ASTM D 2665.

2.1.1 Schedule Pipe (PVC)

Pipe shall be Schedule 40 socket type.

Material shall be PVC Class 12454-B in accordance with ASTM D 1784.

2.1.2 Fittings (PVC)

2.1.2.1 Socket-Type, Schedule 40

Material shall be PVC in accordance with ASTM D 3311.

2.1.3 Cement and Lubricant

Solvent cement for pipe and fittings shall be in accordance with ASTM D 2564.

Thread lubricant shall be in accordance with the pipe manufacturer's recommendations.

2.2 CHLORINATED POLYVINYLCHLORIDE (CPVC) PIPE

CPVC pipe shall be in accordance with ASTM F 441/F 441M.

PART 3 EXECUTION

3.1 PIPE LAYOUT

Installation shall present a neat, orderly appearance. Openings or passageways shall not be blocked.

Piping shall be parallel to exterior walls of building.

Piping shall be kept free from contact with structure or installed items to prevent noise transmission.

3.2 INSTALLATION

Installation drawings shall be submitted.

Plastic piping shall be installed in accordance with the manufacturer's installation instructions.

3.2.1 Vertical Piping

CPVC piping shall be supported at intervals of not more than 3 feet.

All other piping shall be supported at intervals of not more than 4 feet.

Piping shall be secured at sufficiently close intervals to keep pipe in alignment and to support weight of pipe and contents.

Supports shall be installed at each floor.

Piping shall be secured in position by approved stakes or braces when piping is to stand free, or when no structural element is available for providing stability during construction.

3.2.2 Horizontal Piping, Suspended

All piping shall be supported at intervals in accordance with the manufacturer's instructions and in no case not more than 3 feet.

Hangers shall be installed at ends of runs or branches and at each change of direction or alignment.

3.2.3 Horizontal Piping, Underground

Piping shall be laid on a firm bed for the entire trench length, except where otherwise supported.

Partial backfilling and cradling shall be employed to secure piping during backfilling operations.

Piping laid on grade shall be firmly braced prior to embedment in concrete.

3.2.4 Cutting

Cuts shall be made square with pipe and burrs shall be removed by smoothing edges.

3.2.5 Joints

Joints shall be solvent cemented in accordance with ASTM D 2855.

Junction with other materials shall be the type of adapter and technique as recommended by the pipe manufacturer.

-- End of Section --

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SECTION 15110

VALVES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ASME INTERNATIONAL (ASME)

ASME B16.1 (1998) Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250

ASTM INTERNATIONAL (ASTM)

ASTM A 106 (2002) Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service

ASTM A 126/A 126M (1995) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

ASTM B 164 (2003) Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-67 (2002) Butterfly Valves

MSS SP-70 (1998) Cast Iron Gate Valves, Flanged and Threaded Ends

MSS SP-80 (2003) Bronze Gate, Globe, Angle and Check Valves

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS WW-V-35 (Rev C) Valve, Ball

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Fabrication Drawings shall be submitted for the following in

accordance with paragraph entitled, "General Requirements," of this section.

Valves
Accessories

Installation drawings for valves shall be in accordance with the paragraph entitled, "Installation," of this section.

SD-07 Certificates

Listing of Product Installation shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

Certificates shall be submitted for the following items showing conformance to the referenced standards contained in this section.

Globe and Angle Valves
Check Valves
Ball Valves

1.3 GENERAL REQUIREMENTS

Section 15003 GENERAL MECHANICAL PROVISIONS applies to work specified in this section.

Section 15055 WELDING MECHANICAL applies to work specified in this section.

Fabrication Drawings shall be submitted for each type of Valves and Accessories used, meeting referenced standards contained within this section.

Listing of Product Installation shall be submitted for valve assemblies indicating at least five installed units, similar to those proposed for use, that have been in successful service for a minimum of five years.

PART 2 PRODUCTS

2.1 COMPONENTS

2.2 FABRICATION

2.2.1 Globe and Angle Valves

2.2.1.1 125 psi

Valves shall be rated 125-psi (wsp) and shall conform to MSS SP-80, globe or angle, 125-pound.

Valves 2 inches and under in size shall be union bonnet type.

Cast iron shall conform to ASTM A 126/A 126M, Class B.

Stem shall be rising and backseating type.

Composition seating surface disc construction may be substituted for metal plug disc connection.

Plug material for throttling valves 2 inches and under shall be AISI 400 series corrosion-resistant steel hardened to not less than 500 Brinell.

Packing shall be fiber braid impregnated with 30 percent tetrafluoroethylene.

Valve wheels shall be cast iron.

Integral drain valves shall be provided. Main valve boss penetration shall be factory finished and drain assembly shall be field installed. Drain valve shall be gate type. Piping shall be pressure tubing conforming to ASTM A 106, Grade B. Drain discharge shall be capped, and threaded closure assembly shall be made with tetrafluoroethylene tape. All necessary handling and shipping care shall be provided.

2.2.2 Check Valves

2.2.2.1 125 psi

Valves shall be rated 125-psi wsp and standard horizontal swing type shall conform to MSS SP-80, swing check, 125-pound.

Body end connections shall be flanged for all valves larger than 2 inches and screwed in sizes 2 inches and under.

Body to cover connection in sizes larger than 2 inches shall be gasketed-bolted type, and valve body shall be cast iron, conforming to ASTM A 126/A 126M, Class B valves conforming to MSS SP-70. Flanges shall conform to ASME B16.1.

Swing-check pin shall be corrosion-resistant bronze. Swing check angle of closure shall be manufacturer's standard, unless a specific angle is indicated.

Valve disk shall be regrindable metal type.

2.2.3 Ball Valves (BAV)

Ball valves shall conform to FS WW-V-35. Valves shall be Style 3 (removal required for inspection and repair).

Valves shall be rated for service at not less than 175 psi at 200 degrees F.

Valve bodies in sizes 2-inch ips and smaller shall be screwed-end-connection type, constructed of Class A copper alloy.

Balls and stems of valves 2-inch ips and smaller shall be manufacturer's standard Class A copper alloy with 900 Brinell hard-chrome plate finish. Electroless nickel plating is acceptable.

Valves shall be suitable for flow from either direction and shall seal equally tight in either direction.

Valves shall have full-pipe-size flow areas.

Valves with ball seals kept in place by spring washers are not acceptable. Valves shall have adjustable packing glands. Seats and seals shall be tetrafluoroethylene.

Valve body construction shall be such that:

Torque from a pipe with a valve installed shall not tend to disassemble the valve by stripping setscrews or loosening body-end inserts or coupling nuts.

2.2.4 Butterfly Valves (BUV)

2.2.4.1 Metal

Butterfly valves shall conform to MSS SP-67.

Butterfly valves shall be wafer type for mounting between specified flanges and shall be rated for 150-psig shutoff and nonshock working pressure. Body shall be cast-ferrous metal, conforming to requirements of ASTM A 126/A 126M, Class B, and to ASME B16.1 for body wall thickness.

Face-to-face dimensions shall conform to MSS SP-67.

Valves installed in insulated piping systems shall be provided with extended bonnets placing the operator beyond the specified insulation.

Disk shall be free of external ribs and shall be streamlined. Disk shall be fabricated from cast ferrous alloys conforming to ASTM A 126/A 126M, Class B (cast iron).

Use of taper pins to secure the valve disc to the shaft is prohibited.

Shafts shall be fabricated from AISI Type-00 series conforming to ASTM B 164, and shall be one-piece type. Connection between the valve shaft and disk shall be designed to transmit shaft torque equivalent to not less than 75 percent of the torsional strength of the minimum required shaft diameter. Minimum shaft diameter for all valves shall be in accordance with the following:

VALVE SIZE (INCH)	SHAFT DIAMETER (INCH)	VALVE SIZE (INCH)	SHAFT DIAMETER (INCH)
2-1/2	7/16	10	1-1/8
3	1/2	12	1-1/4
4	5/8	14	1-1/2

Seats and seals shall be resilient-elastomer type designed for field removal and replacement. Elastomers shall be Buna-N, formulated for continuous immersion service at 250 degrees F, minimum, and shall be applied at least 10 percent below maximum continuous service temperature. Bonding adhesives shall comply with elastomer temperature requirements and shall have an effective life equal to or greater than the elastomer.

Seals on 20-inch and smaller valves shall be designed to use standard split-V packing, dual O-rings, and quad rings.

Seats may be installed in the valve body except that circular cross section O-ring construction is not acceptable.

Seat or disk matting surfaces shall be corrosion-resistant material such as austenitic gray cast iron and bronzes specified for the disk or the materials specified for stems. These materials shall be welded to substrate and ground. Plated or similarly applied surfacing materials are not acceptable.

Bearings shall be permanently lubricated sleeve type of manufacturer's standard corrosion-resistant steel. Bearings shall be designed for a pressure not exceeding the published design load for the bearing material.

Padlocking feature shall be provided to make valve tamperproof.

For balancing service, valve operators shall have provision for infinite position locking.

Manual nonchain-operated valves through 6 inches shall be provided with not less than nine-position, lever-lock handles not exceeding 18 inches in length.

PART 3 EXECUTION

3.1 INSTALLATION

Valves shall be installed in accordance with the manufacturer's recommendations and in accordance with the applicable requirements of Section 15050 BASIC MECHANICAL MATERIALS AND METHODS.

-- End of Section --

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SECTION 15119

SELF-CONTAINED CONTROL AND RELIEF VALVES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1003 (2001) Water Pressure Reducing Valves

ASME INTERNATIONAL (ASME)

ASME BPVC SEC IV (2001) Boiler and Pressure Vessel Code;
Section IV, Recommended Rules for the Care
and Operation of Heating Boilers

ASTM INTERNATIONAL (ASTM)

ASTM B 61 (2002) Standard Specification for Steam or
Valve Bronze Castings

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

The following shall be submitted for self-contained control and relief valves in accordance with paragraph entitled, "General Requirements," of this section.

Fabrication Drawings

The following shall be submitted for self-contained control and relief valves in accordance with paragraph entitled, "Installation," of this section.

Installation Drawings

1.3 GENERAL REQUIREMENTS

Section 15003 GENERAL MECHANICAL PROVISIONS applies to work specified in this section.

Fabrication Drawings shall be submitted for self-contained control and

relief valves, including part numbers and exploded views.

Listing of Product Installation shall be submitted for self-contained control and relief valves, identifying a minimum of five installed units, similar to those proposed for use, that have been in successful service for a minimum period of five years.

PART 2 PRODUCTS

2.1 SELF-CONTAINED TEMPERATURE-REGULATOR VALVES

Valve shall be direct-operated, self-contained type. The valve body shall be ASTM B 61, (bronze) and rated not less than 125-pounds per square inch (psi) saturated working steam-pressure. Body end connections shall be screwed. Trim shall be corrosion-resistant AISI Type 300 Series steel. Replaceable seat and plug shall be hardened or faced with a cobalt-chromium-tungsten alloy to produce a surface with resistance to impact, wire-drawing, and with a Brinell hardness of not less than 450. Packed steam valves shall be fitted with tetrafluoroethylene packing and shall be spring-loaded and self-adjusting. Valve shall be single-seated, suitable for dead-end service, and shall be fail-safe. Remote Class I or Class III filled-bulb element shall be mounted in a nonferrous separable socket. Valve shall maintain set-point temperature, plus or minus 5 degrees F, with the set point at or near midpoint of the adjustable element range.

2.2 WATER PRESSURE-REGULATING VALVE

Pressure-regulating valve shall conform to ASSE 1003, direct acting.

Pressure-regulating valve shall not stick or allow pressure to build up on the low side. Valve shall be set to maintain a terminal pressure of approximately 5 psi in excess of the static head on the system and shall operate within a 2-pound maximum variation regardless of initial pressure fluctuation, and without objectionable noise under any condition of operation.

2.3 WATER PRESSURE-RELIEF VALVE

Pressure-relief valve shall be constructed, labeled, and installed in accordance with ASME BPVC SEC IV. Relieving capacity shall be as specified by the referenced publication. Valves shall be of nonferrous construction, complete with test lever.

PART 3 EXECUTION

3.1 INSTALLATION

Installation Drawings shall be submitted for self-contained control and relief valves, and valves shall be installed and specified in accordance with the manufacturer's recommendations, and Section 15050 BASIC MECHANICAL MATERIALS AND METHODS.

-- End of Section --

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SECTION 15120

PIPING SPECIALTIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN WATER WORKS ASSOCIATION (AWWA)

- | | |
|-----------|--|
| AWWA C510 | (1997) Double Check Valve
Backflow-Prevention Assembly (Second
Edition) |
| AWWA C511 | (1997) Reduced Pressure Principle
Backflow-Prevention Assembly (First
Edition) |
| AWWA C700 | (2002) Cold Water Meters - Nutating disc
type, Bronze Main Case |

ASME INTERNATIONAL (ASME)

- | | |
|---------------|---|
| ASME A112.1.2 | (1991; R 1998) Air Gaps in Plumbing Systems |
|---------------|---|

PLUMBING AND DRAINAGE INSTITUTE (PDI)

- | | |
|------------|--|
| PDI WH 201 | (1988) Water Hammer Arrestors Standard |
|------------|--|

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Backflow Prevention Devices
Water-Hammer Arresters
Wall Hydrants
Water Meters
Pressure Washers
Water Treatment Systems
Temperature Mixing Valve

SD-07 Certificates

Certificates shall be submitted for the following items showing conformance with the referenced standards contained in this section.

Backflow Prevention Devices
Water-Hammer Arresters
Wall Hydrants
Water Meters

1.3 GENERAL REQUIREMENTS

Section 15003 GENERAL MECHANICAL PROVISIONS applies to work specified in this section.

Detail Drawings shall be submitted for piping specialties consisting of fabrication and assembly drawings for all parts of the work in sufficient detail to enable the Government to check conformity with the requirements of the contract documents.

Pressure Washer
Water Treatment System

Installation drawings shall be submitted for Plumbing Specialties and Equipment in accordance with the manufacturer's recommended instructions and methods.

Pressure Washer
Water Treatment System

Pressure washer and water treatment system shall be of manufacturer listed on Plans or by a manufacturer with similar equipment.

Burden of proof is on the manufacturer of similar equipment to meet the requirements of those items listed on Plans.

PART 2 PRODUCTS

2.1 BACKFLOW PREVENTION DEVICES (VACUUM BREAKERS)

Backflow prevention devices, including airgaps, shall conform to the requirements of ASME A112.1.2, AWWA C510 and AWWA C511.

Airgaps conforming to ASME A112.1.2 shall be constructed of metal, ferrous or nonferrous.

Devices 2-inch iron pipe size (ips) and smaller with moving components, including devices defined in AWWA C510 and AWWA C511, shall be constructed of nonferrous metals; nonmetal components of such devices shall be rated for the application service temperature.

Bodies for devices 2-1/2 inches and larger shall be corrosion-resistant ferrous material or bronze, with flanged connections. Metallic operating components and trim shall be nonferrous. Nonmetallic parts shall be rated for the application service temperature.

External surfaces of devices used in conjunction with equipment with polished or chrome-plated surfaces shall be similarly finished.

External surfaces of devices may be rough castings where these devices are used outside of the building or in equipment rooms.

Devices shall be protected from freezing and shall be installed and used in strict conformance with the manufacturer's instructions.

Devices mounted outside of the building shall be vandalproof.

2.1.1 Type BAG

Type BAG backflow prevention device shall be an airgap casting of ferrous or nonferrous metal.

2.1.2 Type BAT

Type BAT backflow prevention device shall be an atmospheric type for nonpressurized service. Operating device, when installed where very low flow may occur, shall be sufficiently sensitive to preclude spillage and slow leakage of water into surrounding area. BAT device shall be used only where no backpressure may occur.

2.1.3 Type BPT

Type BPT backflow prevention device shall be a pressure type suitable for permanent duty under pressure but without possibility of exposure to backpressure. Operating device shall be spring-loaded. Unit shall consist of shutoffs upstream and downstream of vacuum breaker, one or two check valves, vacuum breaker, and test cocks.

2.1.4 Type BRP

Type BRP reduced-pressure backflow prevention device shall be a standard commercial unit or shall be fabricated from stock parts. Before acceptance for installation, shop drawings and a certificate of performance test of the operational characteristics shall be submitted to the Contracting Officer. Device shall consist of two or more tight-closing check valves, two shutoff valves, reduced-pressure regulating device, and the necessary appurtenances for testing.

2.2 WATER-HAMMER ARRESTERS

Water-hammer arresters shall be commercially manufactured products consisting of bellows arranged to absorb the energy of pressure waves generated by valve closure in a line in which water is flowing. Arresters shall be nonferrous construction, shall be rated as to capacity, and shall be certified in accordance with PDI WH 201.

2.3 WALL HYDRANTS

Wall hydrants shall have brass wall-boxes with nozzles and detachable

T-handles and shall be provided with vandalproof type BAT vacuum breakers. Exterior surfaces shall be chrome-plated.

2.4 WATER METERS

Positive displacement disk meters shall conform to AWWA C700, except as modified by requirements specified herein. Parts wetted by water shall be bronze, rubber, or plastic. Casing shall be flanged in sizes 2-1/2 inches and larger. Registers shall be magnetic drive, straight reading. Maximum pressure drop at maximum capacity shall not exceed 10 psi for meters sized 1-1/2 inches ips and smaller, 15 psi for meters 2 inches ips and larger.

Water meter shall read in gallons. Remote read capability shall be furnished for connection to building EMCS system.

PART 3 EXECUTION

3.1 INSTALLATION

Equipment shall be installed as indicated and specified in accordance with manufacturer's recommendations.

3.2 WATER-HAMMER ARRESTERS

Water-hammer arresters shall be installed in accordance with the manufacturer's printed instructions and PDI WH 201.

-- End of Section --

SECTION 15135

CENTRIFUGAL PUMPS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 11 (1990; R 2000) Load Ratings and Fatigue Life for Roller Bearings

ABMA 9 (1990; R 2000) Load Ratings and Fatigue Life for Ball Bearings

ASME INTERNATIONAL (ASME)

ASME B16.1 (1998) Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250

HYDRAULIC INSTITUTE (HI)

HI SCRRP (1994) Standards for Centrifugal, Rotary and Reciprocating Pumps

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 1940-1 (2003) Mechanical Vibration - Balance Quality Requirements of Rigid Rotors - Part 1: Determination of Permissible Residual Unbalance

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

NEMA MG 1 (2002) Motors and Generators

1.2 DESIGN REQUIREMENTS

Pumps shall be designed using hydraulic criteria based upon actual model developmental test data. Manufacturer shall certify that pumps have been hydraulically tested at the factory.

Pumps shall be selected at a point within the maximum efficiency for a given impeller casing combination. Deviations within 3 percent of maximum efficiency are permissible, provided the lesser efficiency is not less than the scheduled efficiency.

Pumps having impeller diameters larger than 90 percent of the published maximum diameter of the casing or less than 15 percent larger than the

published minimum diameter of the casing will be rejected.

Acceptable maximum impeller diameter calculations shall not be based on percentage of impeller diameter range for a given casing. Shop drawings will be approved only if complete performance curves for all impeller sizes for a given casing are included in the submittal.

Where parallel-pump operation is indicated, pumps selected shall have characteristics specifically suitable for the service without unstable operation.

Pumps shall be suitable for operation at indicated temperature without vapor binding and without cavitation under any system operating condition. The only acceptable means of rectification of cavitation shall be replacement of entire pump assembly.

Available Net Positive Suction Head (NPSH) shall exceed required NPSH by not less than 1-1/2 feet.

Pumps of the same duty condition, classification, and accessories, or with specified accessory deviation, shall be identical and the product of one manufacturing source.

Pumps from more than one manufacturing source shall be provided only when a single manufacturing source is unable to meet all specification requirements.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Installation drawings for centrifugal pumps shall be submitted in accordance with Part 3, "Execution," of this section.

SD-03 Product Data

The following shall be submitted for centrifugal pumps in accordance with paragraph entitled, "General Requirements," of this section.

Equipment and Performance Data

1.4 GENERAL REQUIREMENTS

Section 15003 GENERAL MECHANICAL PROVISIONS applies to work specified in this section.

Section 16225 MOTORS applies to this section.

Equipment and Performance Data consisting of pump curves shall be provided

for each type centrifugal pump.

Equipment Foundation Data shall be submitted for centrifugal pumps.

1.4.1 Factory Tests

The following tests shall be submitted from the manufacturer prior to shipping the pump from the factory, hydraulic tests, efficiency tests, vibration tests, output efficiency tests, surface hardness tests, and shaft deflection tests.

PART 2 PRODUCTS

2.1 GENERAL PUMP REQUIREMENTS

Certificates for pumps and Accessories shall show conformance with the referenced standards contained in this section.

This specification includes design, construction, installation, and performance features of centrifugal water pumps. Pumps provided shall conform to HI SCRRP standards for centrifugal pumps, and to requirements specified herein.

2.1.1 Classification

Class CES: Radially (vertically) split-case, single-stage, close-coupled, distance piece end-suction, single- or double-volute centrifugal type

2.1.2 Casing

Pump casings shall be bronze-fitted, seasoned cast iron with a design working pressure of not less than 185 pounds per square inch gage (psig) at 100 degrees F. Casings shall be single or double volute with flanged piping connections conforming to ASME B16.1, Class 125 psi. Direction of shaft rotation shall be conspicuously indicated. Casing shall have tapped openings for air venting, priming, draining, and suction and discharge gages. A brass or bronze umbrella or vent cock shall be furnished for venting except where automatic air vents are indicated. Drain openings in the volute, intake, or other passages capable of retaining trapped water shall be located in the low point of such passages.

Casing construction shall be such that packing seals may be substituted in the field for mechanical seals without machining.

2.1.3 Impellers

Impellers shall be enclosed cast bronze or corrosion-resistant steel, machined and polished. Waterways shall be machine- or hand-finished. Impellers shall meet maximum and minimum diameter requirements.

2.1.4 Balancing

Pump impeller assemblies shall be statically and dynamically balanced to ISO 1940-1-1986, G6.3. Correction planes needed for additional weight for

balancing shall be determined by using a calibrated and certified balancing machine capable of identifying the magnitude and angular position of any unbalance of the impeller.

2.1.5 Wearing Rings

Wearing rings shall be dissimilar bronze composition for nongalling service. Wearing rings shall be provided in every pump case and on all impellers larger than 7 inches in diameter.

2.1.6 Shaft

Shafts for mechanical-seal service shall be solid or sleeved and all materials shall be AISI Type 304 or 316 corrosion-resistant steel.

Press-fitted sleeves are not acceptable.

Motor shafts of close-coupled pumps shall be manufacturer's standard AISI 18-8 corrosion-resistant steel and finish.

Surfaces shall have a 16-microinch surface finish where packing is specified or where a pump must be convertible to packing seals from mechanical seals. Pump shafts to be sealed by mechanical seals only shall have a 32-microinch surface finish, or better.

Shaft construction shall be substantial to prevent seal or bearing failure due to vibration. Shaft vibration at pump-seal face shall conform to the paragraph entitled, "Pump Acceptance," under shutoff-head operating conditions. Flow from 1/4-inch iron pipe size (ips) pipe shall be provided during testing.

Shaft shall be equipped with bronze or nylon water slingers at each bearing and shall be sealed at the casing interface with a bronze throttling bushing.

2.1.7 Mechanical Seals

Mechanical seals shall be balanced or unbalanced, as necessary to conform to specified service requirements. Mechanical seals shall be constructed in a manner and of materials particularly suitable for the temperature service range and chemical analysis of water being pumped.

Seal construction shall not require external source cooling for pumped-fluid service temperatures up to 250 degrees F.

Seal pressure rating shall be suitable for maximum system hydraulic conditions.

Materials of construction shall include AISI 300 series corrosion-resistant steel, solid tungsten-carbide rotating-seal face, and Buna-N vinylidene-fluoride-hexafluoropropylene, EPT, or tetrafluoroethylene seals.

Bypass flushing water supply shall be free of iron rust products and other abrasive materials and shall be directed onto face of seal without dead

ending. All piping and accessories shall be provided.

Mechanical seals shall not be subjected to hydrostatic test pressures in excess of the manufacturer's recommendations.

2.1.8 Bearings and Lubrication

Bearings shall be heavy-duty ball or roller type with full provisions for the mechanical and hydraulic radial and thrust loads imposed by any normal service condition. Bearings shall be manufactured from vacuum-degassed or processed-alloy steel. Bearings shall have an L-10 rated life of not less than 50,000 hours in accordance with ABMA 9 or ABMA 11. Shop drawings shall bear manufacturer's certification of bearing life.

Bearings shall be permanently lubricated sealed bearings

Bearing housings shall be cast iron, self-aligning on metal-to-metal surfaces and shall totally enclose bearings.

2.1.9 Motors

Pump motors shall be checked for current direction of rotation only after pumps have been primed and approved by the manufacturer's representative and the Contracting Officer.

Motors shall conform to NEMA MG 1

2.1.10 Special Requirements

Plugged or valved casing drains which may require ips red-brass pipe shall be brought out beyond periphery of casing to facilitate drainage. Volute plugs at flanges shall be assembled with tetrafluoroethylene tape.

Pump casing with companion flanges on inlet and outlet connections shall be furnished.

Pump casing and impeller wear rings shall be furnished.

Pump motor shall be an extended-shaft type with special heavy-duty thrust and radial bearings to accommodate motor and pump thrust loads. Impeller shall be mounted directly on the motor-shaft extension.

Pump seals shall be packed type or have the manufacturer's standard mechanical seals for the specified service.

2.2 LINE-MOUNTED PUMPS

Pump shall be the capacity indicated.

Design, construction balancing, and vibration-isolation provisions shall conform to HI SCRRP standards specifically for quiet waterside operation.

Pump casing and seal shall be suitable for operation at pressures up to 125 pounds per square inch at temperatures to 250 degrees F.

Pump casing shall be cast iron.

Pump shall be single-stage, single-suction centrifugal-type, bronze, fitted with mechanical seal. Pump shaft shall be AISI 300 series corrosion-resistant steel or the manufacturer's standard alloy steel with nonferrous-metal-protected wetted surfaces. Coupling shall be elastomer-in-shear or four-spring type. Mechanical seal shall be designed for service with makeup water normal to the site and for 300 ppm of hexavalent chromate in the recirculating system. Pump bearings shall be oil-lubricated sleeve type, with oil reservoirs for extended periods of service without requiring added lubricant.

Motor shall have oil-lubricated sleeve bearings with oil reservoirs for extended periods of service, without requiring added lubricant, and shall be resiliently mounted.

PART 3 EXECUTION

3.1 PUMP PROTECTION

Before any pump is operated, sumps and piping systems shall be cleaned and flushed to remove all particles larger than 1000 micro meter or larger than one-half of the smallest pump axial or radial clearance, whichever is smaller. Permanent and temporary pipeline strainers shall be in place and shall be cleaned frequently to prevent cavitation. Temporary strainers shall not be removed until after system acceptance, unless otherwise approved.

Mechanical-seal flushing water shall be provided with centrifugal separator or 10-micrometer filter element where loose rust may be present at startup.

-- End of Section --

SECTION 15184

HIGH TEMPERATURE WATER SYSTEM WITHIN BUILDINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|--------------|---|
| ANSI A13.1 | (1996; R 2002) Scheme for Identification of Piping Systems |
| ANSI B18.2.1 | (1996; Errata 2003) Square and Hex Bolts and Screws Inch Series |
| ANSI Z53.1 | (1979) Safety Color Code for Marking Physical Hazards |

AMERICAN WELDING SOCIETY (AWS)

- | | |
|----------------|--|
| AWS B2.1 | (2000) Welding Procedure and Performance Qualification |
| AWS D1.1/D1.1M | (2002) Structural Welding Code - Steel |
| AWS Z49.1 | (1999) Safety in Welding, Cutting and Allied Processes |

ASME INTERNATIONAL (ASME)

- | | |
|--------------|---|
| ASME B16.11 | (2002) Forged Fittings, Socket-Welding and Threaded |
| ASME B16.34 | (1996) Valves Flanged, Threaded, and Welding End |
| ASME B16.5 | (1996) Pipe Flanges and Flanged Fittings |
| ASME B16.9 | (2001) Factory-Made Wrought Steel Buttwelding Fittings |
| ASME B18.2.2 | (1987; R 1999) Square and Hex Nuts |
| ASME B31.1 | (2001) Power Piping |
| ASME B40.1 | (1991) Gauges - Pressure Indicating Dial Type - Elastic Element |

ASME BPVC SEC VIII D1 (2001) Boiler and Pressure Vessel Code;
Section VIII, Pressure Vessels Division 1
- Basic Coverage

ASTM INTERNATIONAL (ASTM)

ASTM A 106 (2002a) Seamless Carbon Steel Pipe for
High-Temperature Service

ASTM A 193/A 193M (2003) Alloy-Steel and Stainless Steel
Bolting Materials for High-Temperature
Service

ASTM A 194/A 194M (2003a) Carbon and Alloy Steel Nuts for
Bolts for High Pressure or High
Temperature Service or Both

ASTM A 234/A 234M (2002) Piping Fittings of Wrought Carbon
Steel and Alloy Steel for Moderate and
High Temperature Service

ASTM A 53 (1999b) Pipe, Steel, Black and Hot-Dipped,
Zinc-Coated, Welded and Seamless

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-58 (2002) Pipe Hangers and Supports -
Materials, Design and Manufacture

MSS SP-69 (2002) Pipe Hangers and Supports -
Selection and Application

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.144 Safety Color Code for Marking Physical
Hazards

1.2 DEFINITIONS

1.2.1 High Temperature Water (HTW)

Heating hot water systems operating at greater than 350 degrees F but less
than 450 degrees F.

1.2.2 Terminal Unit

Heat exchanger using HTW as the primary heating medium.

1.3 GENERAL REQUIREMENTS

Section 15050N BASIC MECHANICAL MATERIALS AND METHODS, applies to this
section with additions and modifications specified herein.

1.3.1 Associated Work

Other work associated with this section including insulation, hot water piping, hot water distribution outside the building and painting is covered in other sections of this specification.

1.3.2 Description

The work shall include the furnishing, installing, and testing of high temperature water piping inside the building, as indicated, together with all fittings and appurtenances necessary for a complete and operable system. The work includes connecting to the HTW piping system.

1.3.3 Classes and Maximum Working Pressures

Except as specified otherwise, piping components shall be suitable for use under the maximum working pressures indicated. Except as modified herein, the pressure temperature limitations shall be as specified in the referenced standards and specifications. All pressures in this specification are pressures in pounds per square inch (psi) above atmospheric pressure, and all temperatures are in degrees Fahrenheit (F).

1.3.4 Field Verification

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, verify the maximum operating temperature and pressure of the heating distribution system with the heating plant foreman, and advise the Contracting Officer of any discrepancy within 3 days and before performing any work.

1.3.5 Identification

Each major item of equipment shall have the manufacturer's name, address, type or style, and model or serial number on a plate secured to the item of equipment.

1.3.6 Welding Safety

Safety in welding and cutting of pipe shall conform to AWS Z49.1.

1.3.6.1 Procedures and Qualifications

Before any welding is performed, the Contractor shall submit welding procedure specifications for all metals included in the work, together with proof of its qualification as outlined in ASME B31.1.

Before any welder or operator performs any welding, submit Welder's Performance Qualification Record in conformance with ASME B31.1 showing that the welder was rated under the approved procedure specification submitted by the Contractor. In addition, submit each welder's assigned number, letter, or symbol used to identify the work of the welder, and affix immediately upon completion of the weld. To welders making defective welds after passing a qualification test, give a qualification test and upon failing to pass the test, do not permit to work this contract.

Welders and welding operators previous qualifications on welding procedures test may be accepted for the contract without requalification subject to the approval and provided that all the conditions specified in ASME B31.1 are met before a procedure can be used.

1.4 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Valves

Packing

Gaskets

SD-03 Product Data

Valves

Strainers

Pipe

Pipe fittings

Heat exchanger

SD-07 Certificates

Welding procedure specifications

Performance qualification record

Previous qualifications

Valves

Gaskets

PART 2 PRODUCTS

2.1 PIPE AND PIPE SYSTEM

2.1.1 High Pressure Piping System

ASME B31.1; Maximum operating pressure of 500 psi at 450 degrees F; design pressure of 600 psi.

2.1.2 Pipe

Pipe 2 inches and larger is schedule 40 seamless or electric resistance welded conforming to ASTM A 53 Grade B, Type E or S; or ASTM A 106, Grade B

Pipe 1-1/2-inch and smaller, use schedule 40 seamless conforming to ASTM A 106 Grade B.

All drain and vent lines shall be schedule 80 seamless conforming to ASTM A 106 Grade B

2.1.3 Pipe Fittings

Fittings shall be compatible in thickness with the pipe being used, shall be used in conformance with ASME B31.1, and shall conform to the following requirements. Steel welded fittings: ASTM A 234/A 234M. Flanges shall be serrated or raised-faced type. In horizontal lines, reducing fittings shall be the eccentric type and installed to ensure that the system can be thoroughly drained. Remove raised faces when used with existing flanges having a flat face.

2.1.3.1 Fittings for Steel Pipe Sizes 1/8 to 2 Inches

ASME B16.11, Class 300 steel socket welding type.

2.1.3.2 Fittings for Steel Sizes 2 1/2 Inches and Above

Steel fitting butt welding type ASME B16.9 or ASME B16.5 flanged type, Class 300.

2.1.4 Gaskets

The Contractor shall submit the manufacturers published temperature and pressure ratings and provide materials recommended by the manufacturer for the maximum operating temperature, system design pressure, and service specified herein.

Non-conducting gaskets shall be non-metallic and suitable for operating temperature and pressure of system. Gasket shall withstand compressive and tensile forces caused by thermal expansion and compression of system. Non-conducting gaskets shall be asbestos free and be designed to fit bolt pattern of flanged connection.

2.1.5 Bolting

Bolt studs for flanged joints shall be alloy steel studs, threaded on both ends and fitted with two hexagon nuts per stud. Bolt shall be ANSI B18.2.1 and material shall conform to ASTM A 193/A 193M, Grade B-7, threads Class 7 fit. Nuts shall be American Standard Heavy semi-finished hexagonal (ASME B18.2.2) and material shall conform to ASTM A 194/A 194M, Grade 7.

2.1.6 Vents

Provide air chambers and manual air vent valves as indicated at all high points in the HTW system. Provide a 1/2 inch vent line from each air vent

to the nearest drain. Vent lines shall be provided with two 1/2 inch bar stock globe valves as indicated.

2.1.7 Valves; Gate, Globe, Ball, Check, Angle, and Control

All valve materials shall conform to ASME B16.34. Valve bodies shall be carbon or stainless steel (Type 304 or 316) with stainless steel trim. All valves shall be Class 300. Ends shall be butt welding or raised face flanged type conforming to ASME B16.34. Valve pressure and temperature design values shall not be exceeded. The Contractor shall submit the manufacturers recommended materials list for valves, packing, and gaskets with certification that all meet the system design pressure @ maximum operating temperature and the service as specified herein.

2.1.7.1 Globe Valves

Globe type valves shall have outside screw and yoke with bolt bonnets, and flat seats, but shall not be of the reversed-cup type. The stuffing boxes shall be large and deep. Valves 2 inches and larger shall have at least six U or V type teflon-impregnated braided asbestos packing rings, specifically designated as suitable for high-temperature water. Valves smaller than 2 inches shall have four or five rings. Spiral or continuous packing will not be acceptable. A metal insert shall be provided having proper clearance around the stem at the bottom of the stuffing box and acting as a base for the packing materials. Packing glands shall be furnished with liner of noncorrosive material and shall be of one piece with not less than two bolts. Valves 1 1/4 inches and smaller need not have yokes or bolted screws and deep stuffing boxes. Stems shall be provided with bevel above the disk for cutoff and repacking valve under pressure when fully open. On the underside side of the bonnet a pack-under-pressure bushing of stainless steel shall be provided. The bushing shall be screwed into place.

2.1.7.2 Gate Valves

Gate valves, wedge gate type, outside screw and yoke, valve body with straight through ports without recesses except between seats to assure minimum turbulence, erosion, and resistance to flow. The bonnet shall be equipped with a bonnet bushing. The valves shall have a self-centering male and female joint equipped with a gasket.

2.1.7.3 Temperature Control Valves

Two-way, single seated, equal percentage-flow type, industrial quality flow regulating (control) valve conforming to the materials specified herein, and size selected by the valve manufacturer for the following conditions:

- a. Maximum flow rate: 10 Gpm
- b. Minimum flow rate: 2 Gpm
- c. Internal pressure: 500 (maximum operating) Psi

d. Pressure differential at design load: 5 (open) delta p, Psi

e. Pressure Differential at minimum load: 25 (closed) delta p, Psi

Provide automatic operator with manual override (handwheel) and position indicator. Temperature control valve shall be furnished by Temperature Controls Contractor. coordinate accordingly.

2.1.1.8 Strainers

Body materials shall conform to ASME B16.34, Fine Mesh type strainer and trim shall be Type 304 or 316 stainless steel, selected for the service specified herein.

2.1.1.9 Joints

2.1.1.9.1 Welded Joints

Joints between sections of pipe and between pipe and fittings shall be welded. Joints between pipe and valves shall be welded or flanged. The welding shall conform to requirements of paragraph entitled "Responsibility of Contractor for Fusion Welding." Branch connections may be made with either welding tees or forged branch outlet fittings, either being acceptable without size limitations. Branch outlet fittings where used shall be forged, flared for improved flow where attached to the run, reinforced against external strains, and designed to withstand full pipe-bursting strength.

2.1.1.9.2 Flanged Joints

Joints for connection to valves in high or medium temperature water system shall be welded or flanged, faced true, provided with gaskets, and made perfectly square and tight. Flanges shall be forged steel, raised face, weld-neck type. Slip-on flanges will not be allowed. Where non-conducting gaskets are not indicated on drawings; use spiral flex type.

2.1.1.10 Hangers and Supports

ASME B31.1, MSS SP-58, MSS SP-69, and as specified herein.

2.1.1.11 Pipe Sleeves

Schedule 80 steel pipe, and as specified herein.

2.1.1.12 Calking and Sealants

Materials as recommended by the manufacturer for the service specified herein.

2.1.1.13 Instrumentation

2.1.1.13.1 Pressure Gages

ASME B40.1, with corrosion resistant steel trim for high temperature water

service. Dial range shall be 0 psi to the system design pressure specified herein. Provide stainless steel isolation petcock.

2.1.13.2 Indicating Thermometers

Thermometers shall be dial type with an adjustable angle suitable for the service. Provide thermowell sized for each thermometer in accordance with the thermowell specification. Fluid-filled thermometers (mercury is not acceptable) shall have a nominal scale diameter of 5 inches. Construction shall be stainless-steel case with molded glass cover, stainless-steel stem and bulb. Stem shall be straight, length as required to fit well. Bimetal thermometers shall have a scale diameter of 3 1/2 inches. Case shall be hermetic. Case and stem shall be constructed of stainless steel. Bimetal stem shall be straight and of a length as required to fit the well.

2.1.14 System Terminal Units

2.1.14.1 Heat Exchanger, HTW

Designed for an operating pressure of 500 psig and a temperature of 450 degrees F; factory tested hydraulically to 600 psi; welded steel support brackets or flanges; Class 300 steel primary water flanges; stainless steel or seamless, stress relieved, cupro-nickel (90-10) U-tubes; steel head and flanged opening for easy tube bundle removal; tube sheets and baffles of same material as tubes; steel shell designed for a pressure of 300 psi; opening for ASME pressure relief valve, provided by welded fittings to shell. Arrangement of heat exchanger piping shall be as indicated such that HTW (primary heating medium) is connected to the U-tube side (with offset flanges) and secondary water to the shell side. The heat exchanger shall be designed in accordance with ASME BPVC SEC VIII D1, and carry the code stamp.

PART 3 EXECUTION

3.1 INSTALLATION

Arrange work in a neat and orderly manner so that minimum storage of equipment and material is required at the project site. All parts shall be readily accessible for inspection, repair, and renewal. Protect material and equipment from the weather.

3.2 PIPING

Unless specifically stated to the contrary, fabrication, assembly, welding, soldering, and brazing shall conform to ASME B31.1 for all piping of the hot water system. All piping shall follow the general arrangement shown; cut accurately to measurements established for the work by the Contractor, and work into place without springing or forcing, except where cold-springing is specified. Install piping within buildings entirely out of the way of lighting fixtures and doors, windows, and other openings. Run overhead piping in buildings in the most inconspicuous positions. Provide adequate clearances from walls, ceilings, and floors to permit the welding of joints; at least 6 inches for pipe sizes 4 inches and less, 10 inches for pipe sizes over 4 inches, and in corners provide sufficient clearance

to permit the welder to work between the pipe and one wall. Make provision for expansion and contraction of pipe lines. Make changes in size of water lines with reducing fittings. Do not bury, conceal, or insulate piping until it has been inspected, tested, and approved. Protect materials and equipment from the weather. Do not run piping concealed in walls or partitions or underground or under the floor except as otherwise indicated. Where pipe passes through building structure, do not conceal pipe joints but locate where they may be readily inspected. Run all pipe to be insulated as shown and as required with sufficient clearance to permit application of insulation. Use flanged joints only where necessary for normal maintenance and where required to match valves. Provide gaskets, packing, and thread compounds suitable for the service. Use long radius ells wherever possible to reduce pressure drops. Pipe bends in lieu of welding fittings may be used where space permits. Pipe bends shall have a uniform radius of at least five times the pipe diameter and must be free from any appreciable flattening, wrinkling, or thinning of the pipe. Changes in direction may be made by bending of pipe provided that a hydraulic pipe bender is used. Pipe to be bent shall be steel conforming to ASTM A 53, Class required to match adjoining pipe. Bent pipe showing kinks, wrinkles, or malformations will not be acceptable. Do not use mitering of pipe to form elbows, notching straight runs to form full sized tees, or any similar construction. Make all branch connections with welding tees except factory made forged welding branch outlets or nozzles having integral reinforcements conforming to ASME B31.1. Open ends of pipe lines and equipment shall be properly capped or plugged during installation to keep dirt and other foreign matter out of the system. Pipe not otherwise specified shall be uncoated.

3.2.1 Branch Connections

Branches from supply and return mains shall be taken off as indicated or as approved. Connections shall be carefully made to ensure unrestricted circulation, eliminate air pockets, and permit the complete drainage of the system. Changes in horizontal piping sizes shall be made through eccentric reducing fittings.

3.2.2 Cleaning of Piping (Pre-Erection)

Thoroughly clean each section of pipe, fittings, and valves of all foreign matter before erection as follows: hold each piece of pipe in an inclined position and thoroughly tap along its full length to loosen sand, mill scale and other foreign matter. Pipe 2 inches and larger shall have a wire brush of a diameter larger than that of the inside of the pipe drawn through its entire length several times. Before final connections are made to apparatus, wash out the interior of all piping thoroughly with water. Plug or cap open ends of mains during all shutdown periods. Do not leave lines open at any place where any foreign matter might accidentally enter pipe.

3.2.3 Cleaning of Piping (Post-Erection)

Prior to the hydrostatic, performance and operating tests, the interior of the heat-carrying piping shall be flushed with water until the piping is free of all foreign materials to the satisfaction of the [Contractor

Quality Control representative] [Contracting Officer].

3.2.4 Valves

3.2.4.1 General

Install valves in conformance with ASME B31.1 and as required herein at the locations indicated. Install valves with stems horizontal or above. Locate or equip stop valves to permit operation from floor level, or provide with safe access in the form of walkways or ladders. Install valves in positions accessible for operation and repair.

3.2.5 Identification of Piping and Physical Hazards

Identify all piping & physical hazards in accordance with 29 CFR 1910.144, ANSI A13.1, and ANSI Z53.1. Spacing of identification marks on runs shall not exceed 50 feet. Painting and stencilling shall conform to Section 09900 PAINTS AND COATINGS." Colors shall conform to ANSI Z53.1.

3.2.6 Hangers and Supports

The design and fabrication of pipe hangers, supports, and welding attachments shall conform to MSS SP-58 and ASME B31.1. Hanger types and supports for bare and covered pipe shall conform to MSS SP-69 for the temperature range. Unless otherwise indicated, horizontal and vertical piping attachments shall conform to MSS SP-58. Continuous inserts and expansion joints may be used.

3.2.7 Pipe Sleeves

Provide sleeves where pipes pass through masonry or concrete walls. Sleeves in outside walls below and above grade, shall be steel pipe, Schedule 80. Space between pipe or insulation and the sleeve shall be not less than 1/4 inch. Hold sleeves securely in proper position and location before and during construction. All sleeves shall be of sufficient length to pass through entire thickness of walls, partitions, or slabs. Firmly pack space between the pipe and the sleeve with oakum and caulk on both ends of the sleeve with elastic cement.

3.2.8 Instrumentation

Provide a thermometer and pressure gage, as specified herein, on both the high temperature water supply and return piping located on the system terminal unit side of the isolation valves.

3.3 WELDING

3.3.1 Responsibility of Contractor for Fusion Welding

The Contractor is entirely responsible for the quality of the welding and shall:

- a. Conduct tests not only of the welding procedure used by his organization to determine the suitability of the procedure to

insure welds that will meet the required tests, but also of the welding operators to determine the ability of the operators to make sound welds under standard conditions.

- b. Be thoroughly familiar with ASME B31.1 and with AWS B2.1.
- c. Be capable of performing all welding operations required for construction and installation of the heating system.

3.3.2 Qualifications of Welders

Rules of procedure for qualification of all welders and general requirements for fusion welding shall conform with the applicable portions of ASME B31.1, or with AWS B2.1, and also as outlined below.

3.3.2.1 Examining Welders

Each welder shall be examined at the jobsite by the Contractor in the presence of a representative of the Contracting Officer to determine the ability of the welder to meet the qualifications required. Welders for piping shall be tested and qualified for all applicable positions. Each welder shall be required to identify his weld with his specific code marking signifying his name and number assigned.

3.3.2.2 Examination Results

The Contracting Officer shall be provided with a listing of names and corresponding code markings. Where a welder fails to meet the prescribed welding qualifications, that welder shall be retested, and if he fails the second test, he shall be disqualified for work on the project.

3.3.3 Beveling, Alignment, and Erection

Fabrication of welded pipe joints shall be in accordance with ASME B31.1.

3.3.4 Weld Inspection

Welds shall be inspected for defects in accordance with the following:

- a. Cracks shall not be acceptable regardless of length or location;
- b. Undercut shall not be deeper than 5 percent of the base-metal thickness or 1/32 inch, whichever is less;
- c. Overlap shall not be permitted. The Contracting Officer reserves the right to further examine the welds by other means to establish the soundness of any weld. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and repairs made to the weld at no additional cost to the Government. Repairing defective welds by adding weld material over the defect or by peening will not be permitted. Welders responsible for defective welds may be required to requalify under paragraph entitled "Qualifications of Welders."

3.3.5 Electrodes

Electrodes shall be stored and dried in accordance with AWS D1.1/D1.1M or as recommended by the manufacturer. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.4 QUALITY CONTROL

3.4.1 General Test Requirements

Tests shall be conducted before, during, and after the installation of the system. All instruments, equipment, facilities, and labor required to properly conduct the tests shall be provided by the Contractor. Test pressure gages for a specific test shall be approved by the Contracting Officer and shall have dials indicating not less than 1 1/2 times nor more than 2 times the test pressure. Any deficiencies shall be corrected at the Contractor's expense. Failure to correct any deficiencies will be cause for rejection of the system.

3.4.2 Field Tests

The following field tests shall be conducted when applicable to the system involved. If any failures occur, the Contractor shall make such adjustments or replacements as directed by the Contracting Officer, and the tests shall be repeated at the Contractor's expense until satisfactory installation and operation are achieved.

3.4.2.1 Hydrostatic Tests of Service Piping

All service piping shall be tested hydrostatically before insulation is applied at field joints, and shall be proved tight at a pressure 1 1/2 times the maximum operating pressure or 200 psi, whichever is greater, except hot water lines shall not be tested at more than 600 psi. Hydrostatic test pressures shall be held for a minimum of 4 hours.

3.4.2.2 Operational Tests

After completion of the system, or testable portions thereof, operational tests shall be conducted as in service to demonstrate satisfactory function and operating effectiveness. The tests on each system, or portion thereof, shall last not less than 6 hours.

-- End of Section --

SECTION 15185

REFRIGERATION PIPING, SPECIALTIES and EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING
ENGINEERS (ASHRAE)

ASHRAE 15 (2001) Safety Code for Mechanical
Refrigeration

ASME INTERNATIONAL (ASME)

ASME B16.22 (2002) Wrought Copper and Copper Alloy
Solder Joint Pressure Fittings

ASME B31.5 (2001) Refrigeration Piping and Heat
Transfer Components

ASTM INTERNATIONAL (ASTM)

ASTM A 278 (1993) Standard Specification for Gray
Iron Castings for Pressure-Containing
Parts for Temperatures Up to 650 Degrees F

ASTM B 280 (2003) Standard Specification for Seamless
Copper Tube for Air Conditioning and
Refrigeration Field Service

ASTM B 62 (2002) Standard Specification for
Composition Bronze or Ounce Metal Castings

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J513 (1999) Refrigeration Tube Fittings -
General Specifications Standards

U.S. DEPARTMENT OF DEFENSE (DOD)

MS MIL-F-1183 (1987j) Fittings, Pipe, Cast Bronze,
Silver-Brazing, General Specification for

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS BB-N-411 (2002c) Nitrogen, Technical

1.2 GENERAL REQUIREMENTS

Section 15003, "General Mechanical Provisions," applies to work specified in this section.

As-Built Drawings shall be submitted for refrigeration piping systems providing current factual information including deviations from, and amendments to, the drawings and concealed and visible changes in the work.

Fabrication drawings shall be submitted for Refrigeration Piping and Accessories showing fabrication details to be performed in the shop prior to installation.

System Analysis Development Data shall be submitted showing data on accumulative operating probabilities, such as impact of accumulative tolerances on performance of the refrigeration piping system. Logic diagrams shall indicate the probability of unbalance on a system if out-of-tolerance power exists. Logic data shall depict possible failure modes, probable failure rates, and detailed system level analysis.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

As-Built Drawings shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

SD-03 Product Data

Equipment and performance data shall be submitted for the following items indicating use life, system functional flows, safety features, and features such as electrical system protective device ratings.

Air-cooled Condensing Units

Manufacturer's catalog data shall be submitted for the following items:

- Refrigerant
- Piping
- Filter/Dryers
- Liquid Sight Glasses
- Moisture Indicators
- Air-cooled Condensing Units

SD-06 Test Reports

Test reports shall be submitted in accordance with the paragraph entitled, "Testing," of this section.

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be submitted in accordance with paragraph entitled, "Operation and Maintenance," of this section.

1.4 OPERATION AND MAINTENANCE

Contractor shall submit 6 copies of the Operation and Maintenance Manuals and Spare Parts requirements 30 calendar days prior to testing the refrigeration piping systems. Data shall be updated and resubmitted for final approval no later than 30 calendar days prior to contract completion.

PART 2 PRODUCTS

2.1 GENERAL

All system materials shall comply with applicable requirements of ASHRAE 15, ASME B31.5.

2.2 REFRIGERANT

Refrigerant shall have zero ozone depletion potential. Refrigerant shall be "O" Class similar to R-410A.

CFC HCFC refrigerant shall not be used.

2.3 PURGING AND TESTING NITROGEN GAS

Gaseous nitrogen shall be dry, conforming to FS BB-N-411, Grade A (99.95 percent pure), Type I (gaseous), with minus 70-degree F dewpoint.

2.4 BRAZING ROD

Brazing material shall be AWS Type BCuP-5.

2.5 PIPING

Type CPR-ACR-Copper air-conditioning Refrigeration Piping shall be as follows:

Tubing:

To 7/8-inch outside diameter (od)	Annealed Type K, conforming to ASTM B 280, where bending or flare connection is required
Over 7/8- inch od	Hard-drawn, seamless-copper tubing con- forming to ASTM B 280, No. C12200

Fittings:

To 7/8-inch od	Flared-type, conforming to SAE J513
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Over 7/8- 150-pound per square inch, gage (psig),
inch od wrought-copper socket-joint, conform-
ing to ASME B16.22

All fitting cup depths and tolerances
shall conform to MS MIL-F-1183.

Flexible connectors:

All sizes: Flexible connections for reciprocating equipment shall be the seamless, corrugated, all nonferrous-metal type with external nonferrous metal reinforcing braid. Flexible connections shall be installed in pairs, one at right angle to the other, whether shown or not. Working pressure rating shall have 4 to 1 safety factor at minimum.

2.6 FILTER/DRYERS

Filter/dryers, in sizes 1/2 inch and larger shall be the full-flow, replaceable-core type. Sizes smaller than 1/2 inch shall be the sealed type. Cores shall be of a suitable desiccant that will not plug, cake, dust, channel, or break down but shall remove water, acid, and foreign material from the refrigerant. Dryer shall be constructed so that no desiccant will pass into the refrigerant lines. A filter/dryer shall be provided in the liquid line to each evaporator and shall be piped with a three-valve bypass. Pressure drop through the dryer shall not exceed 2 psi when operating at full connected evaporator capacity.

2.7 LIQUID SIGHT GLASSES

Sight glasses shall be double glass, see-through type, with cover cap on each side. Sight glass shall be provided in liquid line immediately preceding each expansion valve. Glass shall be furnished with a color-change-type moisture indicator.

2.8 MOISTURE INDICATORS

Color-change moisture indicators shall be provided where shown on drawings.

2.9 LINE STRAINERS

Strainers shall be Y-type with removable basket. Strainers in sizes 2-inch iron pipe size (ips) and smaller shall have solder ends; in sizes 2-1/2-inch ips and larger, strainers shall have flanged ends. Minimum body working-pressure rating shall be 250 psig. Body shall have cast-in arrows to indicate direction of flow. All strainer bodies fitted with screwed screen retainers shall have straight threads and shall be gasketed with nonferrous metal. Strainer bodies fitted with bolted-on screen retainers shall have offset blowdown holes. Body material shall be cast bronze, conforming to ASTM B 62, in sizes 2-inch ips and smaller, and cast bronze or cast iron conforming to ASTM A 278, Class 30, in sizes 2-1/2-inch ips and larger.

Minimum free-hole area of strainer element shall be equal to not less than 5 times the internal area of connecting piping. Strainer screens for liquid service shall have perforations not to exceed 0.010 inch (or equivalent wire mesh). Strainer screens for vapor or gas service shall have perforations not to exceed 0.02 inch or equivalent wire mesh. Strainer screens shall have finished ends fitted to machined screen chamber surfaces to preclude bypass flow. Strainer element material shall be AISI Type 304 corrosion-resistant steel.

2.10 PIPING SYSTEMS SUPPORTS

Piping systems support materials shall conform to requirements specified under Section 15050, "Basic Mechanical Materials and Methods," requirements specified herein, and, where not in conflict, the requirements of ASHRAE 15 and ASME B31.5.

Supports for uninsulated copper tubing shall have wide copper-plated bearing surfaces with lead sheet liners between the tube and the support in the contact area, which shall be secured to the support by turned-under edges.

2.11 AIR-COOLED CONDENSING UNIT

Factory assembled and tested, consisting of compressor, condenser coil fan, motors, and refrigerant reservoir.

Listed accessories system shall use HFC (R-410A) refrigerant. No HCFC or CFC refrigerant systems will be allowed.

Compressor shall be hermetically sealed and have rubber vibration isolators. Compressor shall be scroll type with two speed operation for part load control. Compressor shall be furnished with internal overloads, internal relief valve and start assist capacitor and crank case heater. Provide balanced port (externally equalized) thermal expansion valve. Provide high pressure switch, low pressure switch and filter dryer.

2.11.1 Condenser Fan

Direct drive, aluminum propellor fan with permanently lubricated, totally enclosed fan motor with thermal overload protection

2.11.2 Condensor Coil

Seamless copper tube, aluminum fin coil circuited with integral liquid sub-cooler

PART 3 EXECUTION

3.1 INSTALLATION

Equipment shall be installed in accordance with manufacturer's recommendations and in accordance with Section 15050, "Basic Mechanical Materials and Methods."

3.2 TESTING

Testing of system shall be performed in accordance with manufacturer's recommendations and Section 15950, "Testing, Adjusting and Balancing."

-- End of Section --

SECTION 15195

NATURAL GAS SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ASME INTERNATIONAL (ASME)

ASME B16.3 (1998) Malleable Iron Threaded Fittings
Classes 150 and 300

ASME B16.39 (1998) Malleable Iron Threaded Pipe Unions
Classes 150, 250, and 300

ASTM INTERNATIONAL (ASTM)

ASTM A 197/A 197M (2000) Standard Specification for Cupola
Malleable Iron

ASTM A 234/A 234M (2000) Standard Specification for Piping
Fittings of Wrought Carbon Steel and Alloy
Steel for Moderate and High Temperatures

ASTM A 53 (1999; Rev B) Standard Specification for
Pipe, Steel, Black and Hot-Dipped,
Zinc-Coated Welded and Seamless

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-69 (1996) Pipe Hangers and Supports -
Selection and Application

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54 (2002) National Fuel Gas Code

U.S. DEPARTMENT OF DEFENSE (DOD)

MS MIL-L-25567 (Rev D; Am 1) Leak Detection Compound,
Oxygen Systems (Metric)

1.2 GENERAL REQUIREMENTS

Section 15003, "General Mechanical Provisions," applies to work specified in this section.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Piping Materials
Valves
Piping Specialties
Gas Meters

SD-06 Test Reports

Test reports shall be submitted for the following tests in accordance with paragraph entitled, "Testing," of this section.

Leakage
Pressure

PART 2 PRODUCTS

2.1 ABOVEGROUND PIPING MATERIALS

Type BCS-NG: Black carbon steel

Pipe (1/8 inch through 10 inches): Schedule 40 seamless or electric resistance welded black carbon steel, conforming to ASTM A 53, Grade B, Type E.

Fittings (1 inch and under): Class 150 banded black malleable iron screwed, conforming to ASTM A 197/A 197M, ASME B16.3 and ASTM A 234/A 234M

Unions (1 inch and under): Class 250 female, screwed, black malleable iron with brass to iron seat and ground joint, conforming to ASME B16.39 and UL 860

Couplings (1 inch and under): Heavyweight screwed black carbon steel

2.2 PIPING SPECIALTIES

2.2.1 Pressure Regulator and Accessories

Pressure regulator shall be service-type, complete with automatic low-pressure cutoff and automatic pressure relief.

Body shall be cast iron. Valve shall be capable of shutting off under supply pressures to 100 psi. Valve spring range shall be 5.0 to 8.5 inches water gage (wg), and set point shall be 7 inches. Outlet pressure shall vary by not more than 1/2-inch wg from the set point over the capacity range of the regulator.

Pressure relief shall be diaphragm-operated, spring-loaded type with vent for relief of excess pressure. Release set point shall be 12 inches wg.

Low-pressure cutoff regulator shall be adjustable to shut off gas supply entirely if pressure drops below set point. Supply shall remain shut off until manual reset of regulator takes place.

Pressure regulator diaphragm vent and pressure relief vent shall be run as separate, jointless, full size vent lines connected to the vent tapping and terminating at an approved outside location with weatherproof, bugproof, screened vent cap.

2.2.2 Natural Gas Meters

Diaphragm type meter, corrosion-resistant aluminum alloy. Temperature compensation device. Rated at a minimum of 3,000 CFM. Vertical circular reading index reads in cubic feet. Specify gravity 0.6 psig working pressure between 5 inch and 14 inch w.c. 3 inch screwed piping connections. Meter to be equipped with dry contacts for remote reading by building EMCS system.

PART 3 EXECUTION

3.1 ABOVEGROUND PIPING SYSTEMS INSTALLATION

3.1.1 Aboveground Piping

Aboveground piping with operating pressures of 1/2 psig and less, designated "low pressure," shall be fabricated and installed with BCS-NG piping in accordance with NFPA 54, AWS WHB-2.8, MSS SP-69.

Work shall be performed in the presence of the Contracting Officer who shall be notified 48 hours in advance of start of work.

Pipe shall be fabricated to measurements established on the job and shall be carefully worked into place without springing or forcing. Adequate provision shall be made for absorbing all expansion and contraction without stress in any part of the system.

Pipe, tubing, fittings, valves, equipment, and accessories shall be visibly clean and free of foreign material before being installed into the respective systems. Pipe shall be cleaned by hammering, shaking, or swabbing, or by a combination of methods. Lines shall be purged with dry, oil-free compressed air after erection, but purging out shall not be relied upon for removing all foreign matter. Purge velocity shall be equal to 1-1/2 times maximum normal flow velocity. During the progress of construction, open ends of pipe, fittings, and valves shall be properly protected at all times to prevent the admission of foreign matter. Plugs or caps shall be placed in the ends of installed work at all times when connecting work is not actually under way. Plugs shall be commercially manufactured products approved by the Contracting Officer. Outlets, including valve outlets, shall be securely closed gastight with a threaded plug or cap immediately after installation and shall be left closed until

the gas equipment is connected thereto.

Piping shall be installed straight and true with approved offsets around obstructions and with expansion bends or fitting offsets essential to a satisfactory installation, and as may be necessary to increase headroom or to avoid interference with the building construction, electric conduit, or facilities equipment.

Natural gas piping smaller than 1/2-inch ips shall not be concealed.

When installing piping that is to be concealed, the following and similar connections shall not be concealed: unions, tubing fittings, running threads, right and left couplings, and swing joints made by combinations of fittings.

Standard long sweep pipe fittings shall be used for changes in direction; no mitered joints or unapproved pipe bends will be permitted.

Horizontal piping shall have a grade of 1 inch per 100 feet.

Reducers shall be concentric or eccentric. Eccentric reducers shall be used where required to permit proper drainage of pipe lines. Bushings as reducers are not permitted. Drain valves shall be provided in all piping systems at low points.

Installation of piping shall be such as to prevent stresses and strains from being placed on connected equipment.

Dielectric connection shall be provided at inlet side to building pressure regulator.

Expansion bends in steel pipe shall be made from pipe sections and long radius welding elbows in sizes 1 inch and larger. Expansion U-bends shall be cold sprung and welded into the line, which shall be anchored before removing the spreader from the expansion U-bend. Amount of cold spring shall be as indicated.

3.1.2 Joints

Joints larger than 2-inch ips shall be welded.

Pipe ends shall be reamed before joint connections are made.

Screwed joints shall be made up with joint compound.

Joint compounds shall be applied to the male thread only, and care shall be exercised to prevent compound from reaching the interior of the pipe.

Screwed unions, welded unions, or bolted flanges shall be provided wherever required to permit convenient removal of equipment, valves, and piping accessories from the piping system.

Flanged joints shall be assembled with appropriate flanges, gaskets, and bolting. Clearance between flange faces shall be such that the connections

can be gasketed and bolted tight without imposing undue strain on the piping system. Flange faces shall be parallel and the bores concentric. Gaskets shall be centered on the flange faces without projecting into the bore. Bolting shall be lubricated with oil and graphite before assembly to ensure uniform bolt stressing. Flange bolts shall be drawn up and tightened in staggered sequence in order to prevent unequal gasket compression and deformation of the flanges. Wherever a flange with a raised face is joined to a companion flange with a flat face, the raised face shall be machined down to a smooth matching surface and a full face gasket shall be used. After the piping system has been tested and is in service at its maximum temperature, bolting shall be retightened to achieve minimum gasket seating stress recommended by the gasket manufacturer. Only hex-head nuts and bolts shall be used.

Gasket material shall be fresh stock.

Uncoated metallic gaskets shall be assembled with specified compound.

3.1.3 General Service Valve Locations

Valves shall be located to permit isolation of branch piping and each equipment item from the balance of the system and to allow safe and convenient access without moving equipment and with a minimum of piping and equipment disassembly.

Valves shall be provided in piping mains and branches and at equipment where indicated and where specified.

No valve shall be placed in an inaccessible space.

3.2 NATURAL GAS SYSTEMS TESTING

3.2.1 Tests

Prior to acceptance of the work, the Contractor shall test completed systems in the presence of the Contracting Officer.

Tests shall be Pneumatic and shall utilize dry, oil-free nitrogen. Testing shall be done in two stages, preliminary and acceptance.

Personnel not directly involved in pneumatic testing of ferrous piping in excess of 5 psi shall be evacuated from the area.

Testing of any system for any purpose shall include preliminary testing by the process of swabbing of all joints under test with standard high-film-strength soap solution conforming to MS MIL-L-25567, and the subsequent observation for bubbles at internal pressures not in excess of 5 psi.

When testing reveals that Leakage exceeds specified limits, the leaks shall be isolated and repaired, defective materials shall be replaced where necessary, and the system shall be retested until specified requirements are met. Leaking gasket joints shall be remade with new gaskets and new flange bolting. Removed bolting and gaskets shall not be used again.

Leaking tubing joints shall be remade with new fittings and new tube ends.

Only standard piping flanges, plugs, caps, and valves shall be used for sealing off piping for test purposes.

Components that could sustain damage due to test pressure shall be removed from piping systems during testing. Piping system components such as valves shall be checked for proper operation under system test pressure.

No test media shall be added to a system during a test for a period specified or determined by the Contracting Officer.

Duration of a test will be determined by the Contracting Officer and shall be for a minimum of 15 minutes with a maximum of 24 hours. Tests may be terminated by the Contracting Officer at any point during this period after it has been determined that the permissible leakage rate has not been exceeded.

Test material shall be retained in piping system after successful testing until purged by natural gas. No ambient air shall be permitted to enter piping system.

Records of piping systems tests shall be prepared and maintained. Records shall show Governmental and Contractor test personnel responsibilities, dates, test gage identification numbers, ambient temperatures, pressure ranges, rates of pressure drop, and leakage rates. Each acceptance test shall require the signature of the Contracting Officer.

3.2.2 Test Gages

Contractor's test gages shall have dial size 4-1/2 inches or larger with accuracy of plus or minus one-half of 1 percent of full-scale range. Dial graduations and pointer width shall be compatible with readability to one-half the accuracy extremes. Maximum permissible scale range for a given test shall be such that the pointer during a test shall have a starting point at midpoint of the dial or within the middle third of the scale range. Certification of accuracy and correction table shall bear a date within 90 calendar days prior to the test, and shall show test gage number and the project number.

3.2.3 Acceptance Pressure Testing

Testing shall take place during steady ambient temperature conditions.

Ferrous piping systems shall be tested at 75 psig.

Any reduction of test pressures shall be deemed to indicate the presence of leaks which shall be corrected unless the pressure loss can otherwise be accounted for. A correction of plus or minus 0.3 psi will be allowed for each degree change between initial and final system temperature, plus for an increase in temperature and minus for a decrease.

Test duration shall be long enough to determine if there are any leaks but not less than 1 hour for each 500 cubic feet of pipe volume or fraction

thereof, except that when testing a system having a volume of less than 10 cubic feet, the test duration may be reduced to 15 minutes. For piping systems having a volume of more than 24,000 cubic feet, the duration of the test shall be 24 hours.

Control and instrumentation tubing systems shall be tested at 30 psi and the test pressure shall be maintained for a period of not less than 24 hours with no pressure drop.

3.2.4 Purging of Piping

During construction, where necessary, purge valves shall be provided and located to ensure complete system purging with discharge exterior to the building.

3.2.5 Lighting of Pilot Lights

Equipment using natural gas under this Contract shall be lighted in the presence of the Contracting Officer.

-- End of Section --

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SECTION 15211

LOW-PRESSURE COMPRESSED AIR SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ASME INTERNATIONAL (ASME)

ASME B16.3	(1998) Malleable Iron Threaded Fittings Classes 150 and 300
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME B18.2.2	(1987; R 1999) Square and Hex Nuts
ASME B19.3	(1991) Safety Standard for Compressors for Process Industries
ASME B31.3	(2002) Process Piping
ASME B40.100	(1998) Pressure Gauges and Gauge Attachments
ASME BPVC SEC VIII D1	(2001) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

ASTM INTERNATIONAL (ASTM)

ASTM A 183	(2003) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A 197/A 197M	(2000) Standard Specification for Cupola Malleable Iron
ASTM A 307	(2003) Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A 53/A 53M	(2002) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-58	(2002) Pipe Hangers and Supports -
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Materials, Design and Manufacture

MSS SP-69

(2002) Pipe Hangers and Supports -
Selection and Application

MSS SP-72

(1999) Ball Valves with Flanged or
Butt-Welding Ends for General Service

1.2 GENERAL REQUIREMENTS

Section 15003, "General Mechanical Provisions," applies to work specified in this section.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-03 Product Data

Equipment and Performance Data submitted for piping systems.

Manufacturer's catalog data shall be submitted for the following items:

Aboveground Piping Materials
Piping Specialties
Supporting Elements
Air Compressors
Valves
Accessories
Miscellaneous Materials
Vibration Isolation

SD-06 Test Reports

Test reports shall be submitted for the following items in accordance with paragraph entitled, "Compressed Air Systems Testing," of this section.

Hydrostatic Testing
compressed Air Systems Testing
Valve-Operating Tests
Drainage Tests

Each acceptance test shall require the signature of the Contracting Officer and two record copies shall be delivered to the Contracting Officer after acceptance.

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be submitted in accordance with paragraph entitled, "Operation and Maintenance," of this

section.

1.4 GENERAL REQUIREMENTS

Equipment and Performance Data submitted for piping systems shall show conformance with ASME Code.

PART 2 PRODUCTS

2.1 ABOVEGROUND PIPING MATERIALS

2.1.1 Compressed Air Systems 125 Psig and Less

2.1.1.1 Type BCS Black Carbon Steel

Pipe 1/2 through 1-1/2 inches shall be Schedule 40, furnace butt welded, black carbon steel, conforming to ASTM A 53/A 53M, Type F, Grade B.

Pipe 2 through 4 inches shall be Schedule 40, electric resistance welded, black carbon steel, conforming to ASTM A 53/A 53M, Grade B, Type S.

Fittings 2 inches and under shall be 150-pounds per square inch, gage (psig) wsp, banded, black malleable iron, screwed, conforming to ASTM A 197/A 197M and ASME B16.3.

Unions 2 inches and under shall be 250-psig wsp, female, screwed, black malleable iron, with brass-to-iron seat and ground joint conforming to ASME B16.39, ductile iron conforming to ASTM A 536 for grooved pipe couplings.

Couplings 2 inches and under shall be standard weight, screwed, black carbon steel.

2.2 PIPING SPECIALTIES

2.2.1 Air Line Regulators

Pressure reducing station shall be installed complete with relieving type pressure reducing valve, pressure indicator downstream of station, and regulated air pressure relief valve.

Pressure regulator body shall be constructed of zinc or aluminum die castings, rated for the service. Diaphragm shall be reinforced air-, oil-, and water-resistant elastomer. All components, exposed to fluid stream being controlled, shall be of suitable nonmetallic materials. Valves shall be of a balanced construction relieving type to automatically prevent excess pressure buildup.

0-125 psig pressure gauge. 3/8 inch port size for screwed fittings. Nonrising adjustable knob. Spring range of 2-125 psig.

Low pressure 1-60 psig range, standard pressure 2-125 psig range.

2.2.2 Compressed Air Filter

Air filter shall be general purpose type. Grade 216 with capacity of 216 SCFM at 100 psig. 1 inch inlet/outlet screwed connections.

2.2.3 Compressed Air Receivers

Compressed air receivers shall conform to the sizes and capacities specified. Such vessels shall be designed for the applicable working pressures and service in accordance with the ASME BPVC SEC VIII D1, and shall be labeled.

Vessels shall be complete with connections for drain, supports, and other required Accessories.

2.2.4 Air Quick Connect Coupling

Zero pressure connect coupling. Downstream air pressure is relieved automatically before air hose is disconnected. Steel body construction, 1/2 inch body size. End connection is female pipe thread.

2.2.5 Pressure Gages

Pressure gages shall conform to ASME B40.100. Pressure gages shall be Type I, Class 1, (pressure) for pressures indicated. Pressure gage size shall be 3-1/2 inches nominal diameter. Case shall be corrosion-resistant steel conforming to ASTM A 666 with an ASM No. 4 standard commercial polish or better. Gages shall be equipped with damper screw adjustment in inlet connection.

2.2.6 Hose Reel

Field adjustable guide arm with ball bearing swivel. Aluminum casting drive spring. Equipped with 75 feet of 1/2 inch I.D. rubber hose. Hose pressure rated at 300 psi.

2.3 AIR COMPRESSORS

An air compressor of the rotary screw type shall be provided complete with air tank, and other appurtenances. Compressor and installation shall conform to ASME B19.3. Compressor capacity shall be as required for service and provide continuous control air when operating on a 1/3-on 2/3-off cycle. Provide an oil-level sight indicator on the compressor and a coalescing oil filter on the compressor discharge line. Compressor motor shall have soft start capabilities. Motor shall be capable of complete off cycle when not in use.

2.4 VALVES

2.4.1 Ball Valves (BAV)

Ball valves shall conform to MSS SP-72. Valves shall be Style 1.

Grooved end ball valves may be used provided that the manufacturer certifies valve performance in accordance with MSS SP-72.

Valves shall be rated for service at not less than 175 psi at 200 degrees F.

Valve bodies in sizes 3 inch ips and smaller shall be screwed end connection type constructed of Class A copper alloy.

Balls and stems of valves 3 inch ips and smaller shall be manufacturer's standard Class A copper alloy with 900 Brinell hard chrome plating finish. Electroless nickel plating is acceptable.

Valves shall be designed for flow from either direction and shall seal equally tight in either direction.

Valves shall have full pipe size flow areas.

Valves with ball seals kept in place by spring washers are not acceptable. All valves shall have adjustable packing glands. Seats and seals shall be tetrafluoroethylene.

Valve body construction shall be such that torque from a pipe with valve in installed condition shall not tend to disassemble the valve by stripping setscrews or by loosening body end inserts or coupling nuts. Torque from a pipe shall be resisted by a one-piece body between end connections or by bolts in shear where body is of mating flange or surface-bolted construction.

2.5 MISCELLANEOUS MATERIALS

2.5.1 Bolting

Flange and general-purpose bolting shall be hex-head and shall conform to ASTM A 307, Grade B. Heavy hex-nuts shall conform to ASME B18.2.2. Square-head bolts shall not be acceptable.

Grooved couplings shall utilize bolts and nuts of heat treated carbon steel conforming to ASTM A 183.

2.5.2 Escutcheons

Escutcheons shall be manufactured from nonferrous metals and shall be chrome plated except when AISI 300 series corrosion-resistant steel is provided. Metals and finish shall be in accordance with ANSI A112.18.1M.

Escutcheons shall be one-piece type. Escutcheons shall maintain a fixed position against a surface by means of internal spring tension devices or setscrews.

2.5.3 Pipe Thread Compounds

Tetrafluoroethylene tape not less than 2 mils thick shall be used in compressed air systems for pipe sizes to and including 1 inch ips. Tetrafluoroethylene dispersions and other suitable compounds may be used for other applications upon approval by the Contracting Officer.

2.6 SUPPORTING ELEMENTS

Contractor shall provide all necessary piping system components and miscellaneous required supporting elements. Supporting elements shall be suitable for stresses imposed by system pressures and temperatures, and natural and other external forces.

Supporting elements shall be UL-listed and shall conform to requirements of ASME B31.3, MSS SP-58, and MSS SP-69, except as otherwise noted. Type devices specified herein are defined in MSS standards unless otherwise noted.

2.6.1 Building Structure Attachments

Power-actuated anchoring devices shall not be used to support mechanical systems components.

Beam clamps shall be center loading Type 21, UL listed, cataloged, and load rated, and commercially manufactured.

Clamps shall be used to support piping sizes 1-1/2 inches and smaller. C-clamps shall be FM approved and UL listed with hardened cup tip, setscrew, locknut, and retaining strap. Retaining strap section shall be not less than 1/8 by 1 inch. Beam flange thickness to which clamps are attached shall not exceed 0.60 inch.

Concrete inserts shall be constructed in accordance with the requirements of MSS SP-58, for Type 18 and MSS SP-69. When applied to piping in sizes 2 inch ips and larger and where otherwise required by imposed loads, a 1-foot length of 1/2 inch reinforcing rod shall be inserted and wired through wing slots. Approved proprietary-type continuous inserts may be similarly used upon approval by the Contracting Officer.

2.6.2 Horizontal Pipe Attachments

Piping in sizes to and including 2 inch ips shall be supported by Type 6 solid malleable-iron pipe rings except that split-band-type rings may be used in sizes up to 1 inch ips.

Trapeze hangers fabricated from approved structural steel shapes, with U-bolts, shall be used in congested areas and where multiple pipe runs occur. Structural steel shapes shall [conform to supplementary steel requirements] [be a commercially available, proprietary-design, rolled steel].

2.6.3 Vertical Pipe Attachments

Vertical pipe attachments shall be Type 8.

2.6.4 Hanger Rods and Fixtures

Only circular cross-section rod hangers shall be used to connect building structure attachments to pipe support devices. Pipe, straps, or bars of equivalent strength may be used for hangers only where approved by the Contracting Officer.

Turnbuckles, swing eyes, and clevises shall be provided as required by support system to accommodate pipe accessibility and adjustment for load and pitch.

PART 3 EXECUTION

3.1 ABOVE GROUND PIPING SYSTEM INSTALLATION

3.1.1 Piping Systems

Pipe, tubing, fittings, valves, equipment, and Accessories shall be clean and free of all foreign material before being installed in their respective systems. Pipe shall be cleaned by a method approved by the Contracting Officer. Lines shall be purged with dry, oil-free compressed air after erection, but purging shall not be relied upon for removing all foreign matter. Lines shall be purged at a velocity equal to 1-1/2 times maximum normal flow velocity. During the progress of construction, open ends of pipe, fittings, and valves shall be protected at all times to prevent the admission of foreign matter. Except when connections are actually underway, plugs or caps shall be installed on all pipe and component openings. Plugs or caps shall be commercially manufactured products.

Piping shall be installed straight and true, with approved offsets around obstructions and with necessary expansion bends or fitting offsets essential to a satisfactory installation and as may be necessary to increase headroom or to avoid interference with the building construction, electric conduit, or facilities equipment.

Standard long sweep pipe fittings shall be used for changes in direction. No mitered joints or unapproved pipe bends shall be permitted.

Tee connections shall be made with screwed tee fittings or grooved tee fittings, or, where pipe is being welded, branch connections shall be made with either welding tees or forged branch outlet fittings, either being acceptable without size limitations. Branch outlet fittings shall be forged, flared for improved flow where attached to the run, reinforced against external strains, and designed to withstand full burst-pressure strength requirements. Tool space shall be provided between parallel piping runs whenever threaded unions or couplings are installed.

Horizontal piping shall have a grade of 1 inch per 50 feet.

Eccentric reducers shall be used where required to permit proper drainage of pipe lines. Bushings shall not be permitted for this purpose. Drain valves shall be provided in piping systems at low points. Pipe drains shall consist of 1/2 inch ball valves with 3/4 inch hose adapter.

Installation of piping shall be performed in a manner that will prevent stresses and strains from being imposed on connected equipment.

3.1.2 Joints

Pipe ends shall be reamed before joint connections are made.

Screwed joints shall be made up with joint compound.

Joint compounds shall be applied to the male thread only, and care shall be exercised to prevent compound from reaching the interior of the pipe.

Screwed unions, welded unions, or bolted flanges shall be provided wherever required to permit convenient removal of equipment, valves, and piping Accessories from the piping system.

Flanged joints shall be assembled with appropriate flanges, gaskets, and bolting. Clearance between flange faces shall be such that the connections can be gasketed and bolted tight without imposing undue strain on the piping system. Flange faces shall be parallel and the bores concentric. Gaskets shall be centered on the flange faces without projecting into the bore. Bolting shall be lubricated with oil and graphite before assembly to ensure uniform bolt stressing. Flange bolts shall be drawn up and tightened in staggered sequence to prevent unequal gasket compression and deformation of the flanges. Wherever a flange with a raised face is joined to a companion flange with a flat face, the raised face shall be machined to a smooth matching surface, and a full facegasket shall be used. After the piping system has been tested and is in service at its maximum temperature, bolting shall be retightened. Only hex-head nuts and bolts shall be used. Gasket material shall be fresh stock, 1/16 inch thick.

3.1.3 General Service Valve Locations

Valves shall be provided to permit isolation of branch piping and each equipment item from the balance of the system, to allow safe and convenient access without moving equipment, and to require a minimum of piping and equipment disassembly.

Valves shall be provided in piping mains and branches at equipment and equipment items.

Riser and downcomer drains shall be provided above piping shutoff valves in piping 2-1/2 inches and larger. Shutoff valve body shall be tapped and fitted with a 1/2 inch plugged globe valve.

3.1.4 Supporting Elements Installation

Supporting elements shall be provided in accordance with the requirements of ASME B31.1, MSS SP-58, MSS SP-69. Piping shall be hung from building construction. No piping shall be hung from roof deck or from other pipe.

Attachment to building construction concrete shall be by approved cast-in concrete inserts wherever possible. Attachment to building construction solid masonry shall be by built-in anchors. Where attachment by either of above methods is not possible, specified masonry anchor devices may be used upon receipt of written approval from the Contracting Officer.

Masonry anchors selected for overhead applications shall be constructed of ferrous materials only.

Masonry anchors conforming to FS FF-S-325 Group I, Class 2, Style 1; shall be installed in rotary, nonpercussion, electric drilled holes. Group III self-drilling anchors may be used provided masonry drilling is done with electric hammers selected and applied in a manner that will preclude concrete spalling or cracking both visible or invisible. Pneumatic tools shall not be allowed.

Percussive action, electric hammers, and combination rotary-electric hammers used for the installation of self-drilling anchors shall be selected in accordance with the following guide:

For nominal anchor device sizes 1/4- through 1/2 inch, the tool shall be hammer type only or combination rotary-hammer type and shall be rated at load to draw not more than 5.0 amperes when operating on 120-volt, 60-hertz power.

For nominal anchor device sizes 5/8 inch and larger, the hammer type only tool shall be rated at load to draw not more than 8.0 amperes when operating on 120-volt, 60-hertz power. Combination rotary hammer tools on the same power supply shall have a full-load current rating not to exceed 10 amperes.

Inserts and anchors shall be sized for the total stress to be applied with a safety factor as required by applicable codes but in no case less than 4.

Anchor devices shall be inserted into concrete sections not less than twice the overall length of the device and shall be located not less than the following applicable distance from any side or end edge or centerline of adjacent anchor service:

Anchor Bolt	Minimum Edge
<u>Length (Inches)</u>	<u>Space (Inches)</u>
1/4	3-1/2
5/16	3-3/4
3/8	4
1/2	5
5/8	6
3/4	7
7/8	8

In special circumstances, upon prior written approval of the Contracting Officer, center-to-center distance may be reduced to 50 percent of given distance provided the load on the device is reduced in direct proportion to reduced distance.

Piping shall run parallel with the lines of the building. Piping and components shall be spaced and installed so that a threaded pipe fitting may be removed between adjacent pipes and so that there will be not less than 1/2 inch of clear space between the finished surface and other work and between the finished surface and parallel adjacent piping. Hangers on different adjacent service lines running parallel with each other shall be

arranged to be in line with each other and parallel to the lines of the building.

Identical service systems piping, where practical, shall be placed at same elevation and hung on trapeze hangers adjusted for proper pitch.

Spacing of trapeze hangers where piping is grouped in parallel runs shall be the closest interval required for any size pipe supported.

Where it is necessary to avoid any transfer of load from support to support or onto connecting equipment, pipe hangers shall be constant support type.

Approved pipe alignment guides, attached in an approved manner to the building structure, shall be provided to control pipe movement in true alignment in the piping adjacent to and on each side of all pipe expansion loops.

Anchors incorporated in piping systems for the purpose of maintaining permanent pipe positions shall be welded to the piping and attached to the building structure in a manner approved by the Contracting Officer.

Piping shall be suitably braced against sway and vibration. Bracing shall consist of brackets, anchor chairs, rods, and structural steel for Vibration Isolation.

When the hanger load exceeds the above limits, the reinforcing of the roof purlin(s) or additional support beam(s) shall be furnished and installed. When an additional beam is used, the beam shall bear on the top chord of the roof trusses, and bearing shall be over gusset plates of top chord. Beam shall be stabilized by connection to roof purlin along bottom flange.

Hangers and supports for piping shall be installed at intervals specified herein at locations not more than 3 feet from the ends of each runout and not over 25 percent of the specified interval from each change in direction of piping.

Load rating for all pipe hanger supports shall be based on weight and forces imposed on all lines. Deflection per span shall not exceed slope gradient of pipe. Schedule 40 and heavier pipe supports shall be in accordance with the following minimum rod size. Maximum allowable hanger spacing and concentrated loads will reduce allowable span proportionately:

PIPE SIZE <u>INCHES</u>	ROD SIZE <u>INCHES</u>	STEEL PIPE <u>FEET</u>
Up to 1	3/8	8
1-1/4 to 1-1/2	3/8	10
2	3/8	12
2-1/2 to 3-1/2	1/2	12
4 to 5	5/8	16

PIPE SIZE <u>INCHES</u>	ROD SIZE <u>INCHES</u>	STEEL PIPE <u>FEET</u>
6	3/4	16
8 to 12	7/8	20

Where possible, vertical risers shall be supported at the base at intervals specified and shall be guided for lateral stability. Clamps shall be placed under fittings wherever possible. Carbon steel pipe shall be supported at each floor at not more than 15-foot intervals for pipe 2 inches and smaller and at not more than 20-foot intervals for pipe 2-1/2 inches and larger.

After the piping systems have been installed, tested, and placed in satisfactory operation, the Contractor shall firmly tighten hanger rod nuts and jam nuts to prevent any movement.

3.2 COMPRESSED AIR SYSTEMS TESTING

Prior to acceptance of the work, completed systems shall be pressure-tested in the presence of the Contracting Officer.

Testing shall be done in two stages: preliminary stage and acceptance stage, including gage tests.

No testing shall be performed until personnel not directly involved in the test have been evacuated from the area.

Contractor may conduct tests for his own purposes, but preliminary testing and the acceptance test shall be conducted as specified.

3.2.1 Preliminary Stage Tests

Tests shall be pneumatic and shall use dry, oil-free compressed air.

Testing of any system for any purpose shall include preliminary testing by swabbing joints under test with standard high-strength film soap solution and observing for bubbles at internal pressures not in excess of 5 psi.

When testing reveals that leakage exceeds specified limits, the leaks shall be isolated and repaired, defective materials shall be replaced where necessary, and the system shall be retested until specified limits are met.

Leaking gasket joints shall be remade with new gaskets and new flange bolting, and used bolting and gaskets shall be discarded.

Other than standard piping flanges, plugs, caps and valves, only commercially manufactured expandable elastomer plugs shall be used for sealing off piping for test purposes. Published safe test pressure rating of any plug used shall be not less than three times the actual test pressure being applied. During pneumatic testing or hydrostatic testing, personnel shall be evacuated from areas where plugs are used.

Components that could be damaged by test pressure shall be removed from piping systems to be tested.

Valve-Operating Tests and Drainage Tests shall be performed according to referenced standards.

Piping system components, such as valves, shall be checked for proper operation under system test pressure.

No test media shall be added to a system during a test for a period specified or determined by the Contracting Officer.

Duration of a test will be determined by the Contracting Officer and will be for a minimum of 15 minutes with a maximum of 24 hours. Test may be terminated by direction of the Contracting Officer at any point after it has been determined that the leakage rate is within limits.

Test records of all piping systems tests shall be prepared and maintained. Records shall show Governmental and Contractor test personnel responsibilities, dates, test gage identification numbers, ambient temperatures, pressure ranges, rates of pressure drop, and leakage rates.

To preclude injury and damage, necessary precautions shall be taken by venting the expansive force of compressed air trapped during high-pressure Hydrostatic Testing. When purging or vent valves are not provided, the Contracting Officer may require the removal of any system component such as plugs or caps to verify that the water has reached all parts of the system.

3.2.2 Test Gages

Contractor's test gages shall conform to ASME B40.100 and shall have a dial size of 8 inches or larger. Maximum permissible scale range for a given test shall be such that the pointer during a test shall have a starting position at midpoint of the dial or within the middle third of the scale range. Certification of accuracy and correction table shall bear a date within 90 calendar days prior to test use, test gage number, and the project number, unless otherwise approved by the Contracting Officer.

3.3 COMPRESSED AIR SYSTEM CLEANING

Rust and dirt shall be removed from the bore and exterior surface of all piping and equipment. Pipeline strainers, temporary and permanent, shall be cleaned during purging operations, after startup, and immediately prior to final acceptance by the Government.

New steel piping shall be flushed and cleaned with a suitable degreasing agent, until visible, grease, dirt, and other contaminants have been removed. Degreased waste material including the degreaser itself shall be disposed of in accordance with written instructions received from the Environmental authority having jurisdiction through the Contracting Officer and in accordance with all Local, State and Federal Regulations.

3.4 COMPRESSED AIR SYSTEMS IDENTIFICATION

Identification plates shall be protected and kept clean. Damaged and illegible identification plates shall be replaced at no additional expense.

Piping shall be labeled and arrowed at each point of entry and exit of piping passing through walls; at each change in direction, such as at elbows and tees; and in congested or hidden areas, at each point required to clarify service or indicate a hazard. Each riser shall also be labeled.

In long straight runs, labels shall be located at distances visible to each other, but in no case shall the distance between labels exceed 75 feet. Labels shall be legible from the primary service and operating area.

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SECTION 15410

PLUMBING FIXTURES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A117.1 (1992) Standard for Buildings and Facilities and Usability for physically handicapped people

ANSI Z358.1 (1998) Standard for Emergency Eyewash and Shower Equipment

ASME INTERNATIONAL (ASME)

ASME A112.19.2M (1998) Vitreous China Plumbing Fixtures Supplement 1-June 2000

INTERNATIONAL CODE COUNCIL (ICC)

ICC IPC (2000) International Plumbing Code

U.S. DEPARTMENT OF ENERGY (DOE)

DOE WS-1 (2000) How to Buy a Water-Saving Faucet

DOE WS-2 (2000) How to Buy a Water-Saving Showerhead

DOE WS-3 (2000) How to Buy a Water-Saving Replacement Toilet

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS WW-P-541/4 (Rev B; Am 1) Plumbing Fixtures (Lavatories)

FS WW-P-541/7 (Rev C; Am 1) Plumbing Fixtures (Shower Bath, and Emergency Eye and Face Wash Outfits)

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Records of Existing Conditions shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items including all spare parts.

Plumbing Fixtures and Trim
Sanitary Drain, Waste, and Vent Fixtures

SD-04 Samples

Manufacturer's Standard Color Charts shall be submitted in accordance with paragraph entitled, "General," of this section.

SD-07 Certificates

Listing of Product Installation shall be submitted in accordance with paragraph entitled, "Installation," of this section.

Certificates shall be submitted for the following items showing conformance with the referenced standards contained in this section.

Plumbing Fixtures and Trim
Sanitary Drain, Waste, and Vent Fixtures

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be submitted in accordance with paragraph entitled, "Operation and Maintenance," of this section.

1.3 GENERAL REQUIREMENTS

Section 15003 GENERAL MECHANICAL PROVISIONS applies to this section.

Records of Existing Conditions shall be submitted consisting of the results of Contractor's survey of work area conditions and features of existing structures and facilities within and adjacent to the jobsite. Commencement of work shall constitute acceptance of existing conditions.

PART 2 PRODUCTS

2.1 GENERAL

Fixtures shall be of the types defined herein and of the size and capacities indicated.

Manufacturer's Standard Color Charts shall be submitted for plumbing fixtures showing the manufacturer's recommended color and finish selections.

2.2 PLUMBING FIXTURES AND TRIM

Fixtures shall be furnished with the accessories for a complete installation, such as supply fittings, angle valves, escutcheons, couplings, nuts, drain fittings, and pop-up waste fittings, even if the accessories are not specifically called out herein. Rubber compression type connections are not acceptable and brass ferrule type fittings are required.

Vitreous-china and enameled cast-iron plumbing fixtures shall be the product of the same manufacturer, and unless otherwise specified, shall be white. Manufacturer shall be a company of established reputation in the manufacture of plumbing fixtures and one that assembles the plumbing outfits and assumes responsibility for all products supplied.

Exposed traps and double-cone supply tubes for fixtures and equipment shall be connected to rough-piping at the wall, unless otherwise specified. Floor and wall plates shall be as specified herein or as covered by the outfit numbers. Exposed-to-view fixture trimmings, fittings, and fasteners shall be chromium-plated or nickel-plated brass with polished, bright surfaces.

Supplies and wastes for lavatories shall be to wall. Sleeves are not required at penetrations.

Ledge-back openings shall be located to place the faucet spout over the bowl drain.

2.2.1 Fixture Supports

Wall-hung fixtures shall be supported by ferrous-metal carriers. Where specified, carriers shall be combination type with adjustable fittings. Water closets and urinals shall have supporting feet not less than 10 inches long, unless construction requires shorter feet or bases.

2.2.2 Lavatories

Lavatories and fittings shall conform to FS WW-P-541/4.

Type L-C: Lavatories shall be Type IV (countertop), Class 2 (oval), vitreous china, dimensions as indicated with front overflow, oval shaped, with 4 inch centers.

Supply fittings shall conform to applicable requirements for faucets in FS WW-P-541/4 and shall be in accordance with the recommended levels specified in DOE WS-1.

Supply fitting shall be a 4-inch centerset type with a vandalproof aerator. Aerator shall provide no more than 1.5 gpm water flow at 60 psi.

Supply piping shall be chrome-plated brass, threaded in accordance with the requirements of FS WW-P-541/4.

Drain fittings shall conform to FS WW-P-541/4, strainer drain and 1-1/4-inch tailpiece. Adjustable P-trap, with cleanout, shall be Type I and offset for accessible casework as indicated.

2.2.3 Water Closets

Water closets shall conform to ASME A112.19.2M.

Water closets shall be in accordance with the recommended levels specified DOE WS-3.

Water closets shall be office and industrial, elongated bowl with flush valve, floor mount, and constructed for quiet operation. Seat shall be elongated open front, solid molded high-impact polystyrene, with check hinge, and without a cover.

2.2.4 Flush Valve Urinals

ASME A112.19.2M, white vitreous china, wall-mounted, wall outlet, siphon jet, integral trap, and extended side shields. Provide urinal with the rim 17 inches above the floor. Water flushing volume of the urinal and flush valve combination shall not exceed 1.0 gallons per flush. Provide ASME A112.6.1M concealed chair carriers with vertical steel pipe supports. Provide large diameter flush valve including angle control-stop valve, vacuum breaker, tail pieces, slip nuts, and wall plates; exposed to view components shall be chromium-plated or polished stainless steel. Flush valves shall be nonhold-open type. Mount flush valves not less than 11 inches above the fixture. Provide piston type, flush valve and wall support.

2.2.5 Kitchen Sinks

ASME A112.19.3M, 18 gage stainless steel with integral mounting rim for flush installation, minimum dimensions of 19 inches wide by 18 inches front to rear, one compartment, with undersides fully sound deadened, with supply openings for use with top mounted washerless sink faucets with hose spray, and with 3.5 inch drain outlet. Provide stainless steel drain outlet and stainless steel cup strainer. Provide separate 1.5 inch P-trap and drain piping to vertical vent piping.

2.2.6 Plastic Shower Stalls

IAPMO Z124.2 four piece white solid acrylic pressure molded fiberglass reinforced plastic shower stalls. Shower stalls shall be scratch resistant, waterproof, and reinforced. Provide recessed type shower stalls approximately 36 inches wide, 36 inches front to rear, 75 inches high, and 5 inch high curb with shower stall bottom or feet firmly supported by a smooth level floor. Provide PVC shower floor drains and stainless steel strainers. Shower stalls shall meet performance requirements of IAPMO Z124.2 and shall be labeled by NAHB Research Foundation, Inc. for compliance. Install shower stall in accordance with the manufacturer's written instructions. Finish installation by covering shower stall attachment flanges with dry-wall in accordance with shower stall manufacturer's recommendation. Provide smooth 100 percent silicone rubber

white bathtub caulk between the top, sides, and bottom of shower stalls and bathroom walls and floors.

2.2.7 Shower Fittings

Shower fittings shall conform to FS WW-P-541/7 with concealed piping and pressure-balancing mixing valve. Shower head shall be Type I, Class 2 (adjustable). Showerheads shall be in accordance with the recommended levels specified in DOE WS-2. Showerhead shall have volume control flow device providing no more than 1.5 gpm at 60 psi.

2.2.8 Thermostatic Mixing Valves

Mixing valves, thermostatic type, pressure-balanced or combination thermostatic and pressure-balanced shall be line size and shall be constructed with rough or finish bodies either with or without plating. Each valve shall be constructed to control the mixing of hot and cold water and to deliver water at a desired temperature regardless of pressure or input temperature changes. The control element shall be of an approved type. The body shall be of heavy cast bronze, and interior parts shall be brass, bronze, corrosion-resisting steel or copper. The valve shall be equipped with necessary stops, check valves, unions, and sediment strainers on the inlets. Mixing valves shall maintain water temperature within 5 degrees F of any setting.

2.2.9 Drinking-Water Coolers

ARI 1010 with more than a single thickness of metal between the potable water and the refrigerant in the heat exchanger, wall-hung, bubbler style, air-cooled condensing unit, 4.75 gph minimum capacity, stainless steel splash receptor and basin, and stainless steel cabinet. Bubblers shall be controlled by push levers or push bars, front mounted or side mounted near the front edge of the cabinet. Bubbler spouts shall be mounted at maximum of 36 inches above floor and at front of unit basin. Spouts shall direct water flow at least 4 inches above unit basin and trajectory parallel or nearly parallel to the front of unit. Provide ASME A112.6.1M concealed steel pipe chair carriers.

2.2.10 Emergency Eyewash and Shower

ISEA Z358.1, floor supported free standing unit. Provide deluge shower head, stay-open ball valve operated by pull rod and ring or triangular handle. Provide eyewash and stay-open ball valve operated by foot treadle or push handle.

2.3 SANITARY DRAIN, WASTE, AND VENT FIXTURES

2.3.1 Floor Drains

Floor drains shall be complete with traps.

Floor drains located in slabs on earth shall have hub outlets.

Ferrous floor drain surfaces, except the top of grates, shall be given a

heavy coating of coal-tar enamel. Coating shall be applied either at the factory or in the field before installation and before rusting has occurred.

Trap primers shall be all bronze with nonferrous trim floor. Drains shall be fitted with cast-iron primer adapters.

Trench drain shall have presloped integral channel. Body of drain shall be made of polymer concrete material. Cast-in-place metal rail edge shall be provided on those drains indicated on drawings. Grating shall be Class C rated for heavy traffic loads. Cast iron slotted design.

2.3.2 Cleanouts

Cleanouts shall be gastight and watertight and sized to provide quick and easy access for plug removal and rodding tools. Cleanouts shall be aesthetically located with respect to tile patterns, masonry bond, and alignment.

Cleanouts in ceramic tile, resilient tile flooring, and finished walls shall be rectangular.

No cleanout plug shall terminate in or above a finished floor or wall surface, except in stack bases and where indicated.

PART 3 EXECUTION

3.1 INSTALLATION

Listing of Product Installation shall be submitted for plumbing fixtures identifying at least five units, similar to those proposed for use, that have been in successful service for a minimum of five years. The list shall include purchaser, address of installation, service organization, and date of installation.

Materials, equipment, and fixtures shall be installed as indicated and specified and in accordance with the manufacturer's recommendations.

Installation of plumbing fixtures shall conform to the published or written instructions of the manufacturer for the specific project application, except as otherwise specified herein.

Fixtures shall be clean and free of deleterious material before being installed. Before connecting to water, waste, vent or trap service, the fixture lines shall be blown out with compressed air. During the progress of construction, open ends of fixtures shall be protected at all times to prevent the admission of foreign matter.

3.2 TESTS

The floor drain body and its standard specification strainer shall be tested in compression, while loaded with a 120,000-pound capacity hydraulic machine, by means of a 2-1/2-inch square, 1-inch thick platen placed at the geometric center of the strainer. Deflection measurements from the bottom of the platen shall be taken using a deflection gage graduated in

0.001-inch increments. Cast-iron strainers shall be loaded as rapidly as possible; load-to-failure shall be applied within 2 to 2.5 seconds, and maximum deflection at failure by cracking shall be noted. Ductile-iron and nonferrous strainer permanent deformation shall constitute failure. These strainers shall be loaded to a deflection of 1/16 inch without permanent deformation and to a deflection of 1/8 inch at which or before which, permanent deformation will occur.

Leak tests shall be conducted in accordance with ICC IPC, except as otherwise provided herein. Tests shall be hydrostatic, unless otherwise specified. Only potable water shall be used for testing. Government will supply the test water, but the Contractor shall be responsible for approved disposal of contaminated water.

Duration of the test will be determined by the Contracting Officer, who may also terminate the test at any point after it has been determined by the Contracting Office that fixtures are watertight.

Record of testing shall be maintained by the Contractor and shall be submitted to the Contracting Officer upon acceptance of the equipment by the Government.

3.3 OPERATION AND MAINTENANCE

Contractor shall submit 6 copies of the Operation and Maintenance Manuals 30 calendar days prior to testing of plumbing fixtures. Data shall be updated and resubmitted for final approval by the Contracting Officer no later than 30 calendar days prior to contract completion.

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SECTION 15486

FUEL-FIRED WATER HEATERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

This Section includes the following fuel-fired water heaters:

Commercial, high-efficiency, gas water heaters.
Water heater accessories.

1.3 SUBMITTALS

Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

Product Certificates: For each type of commercial water heater, signed by product manufacturer.

Source quality-control test reports.

Field quality-control test reports.

Operation and Maintenance Data: For water heaters to include in emergency, operation, and maintenance manuals.

Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 WARRANTY

Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired water heaters that fail in materials or workmanship within specified warranty period.

Failures include, but are not limited to, the following:

Structural failures including storage tank and supports.
Faulty operation of controls.
Deterioration of metals, metal finishes, and other materials beyond normal use.

Warranty Period(s): From date of Substantial Completion:

Commercial, Gas Water Heaters:

- 1) Storage Tank: Three years.
- 2) Controls and Other Components: Three years.

Compression Tanks: One year.

PART 2 PRODUCTS

2.1 COMMERCIAL, GAS WATER HEATERS

Commercial, High-Efficiency, Gas Water Heaters: Comply with ANSI Z21.10.3/CSA 4.3.

Description: Manufacturer's proprietary design to provide at least 94 percent combustion efficiency at optimum operating conditions. Following features and attributes may be modified or omitted if water heater otherwise complies with requirements for performance.
Storage-Tank Construction: ASME-code steel with 150 psig minimum working-pressure rating.

Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

- 1) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
- 2) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

Lining: Glass complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

Factory-Installed, Storage-Tank Appurtenances:

Anode Rod: Replaceable magnesium.
Dip Tube: Provide unless cold-water inlet is near bottom of tank.
Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
Jacket: Steel with enameled finish.

Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for high-efficiency water heaters and for natural-gas fuel.

Temperature Control: Adjustable thermostat.

Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.

Energy Management System Interface: Normally closed dry contacts for enabling and disabling water heater.

2.2 COMPRESSION TANKS

Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

Construction:

Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.

Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

Air-Charging Valve: Factory installed.

2.3 WATER HEATER ACCESSORIES

Gas Shutoff Valves: ANSI Z21.15/CGA 9.1, manually operated. Furnish for installation in piping.

Combination Temperature and Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select each relief valve with sensing element that extends into storage tank.

Gas Water Heaters: ANSI Z21.22/CSA 4.4.

Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

2.4 SOURCE QUALITY CONTROL

Hydrostatically test commercial water heater storage tanks before shipment to minimum of one and one-half times pressure rating.

Prepare test reports.

PART 3 EXECUTION

3.1 WATER HEATER INSTALLATION

Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

Install gas water heaters according to NFPA 54.

Install gas shutoff valves on gas supplies to gas water heaters without shutoff valves.

Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater, relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 15 Section "Plumbing Specialties" for hose-end drain valves.

Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.

Fill water heaters with water.

Charge compression tanks with air.

3.2 CONNECTIONS

Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.

Ground equipment according to Division 16 Section "Grounding and Bonding."

Connect wiring according to Division 16 Section "Conductors and Cables."

3.3 FIELD QUALITY CONTROL

Perform the following field tests and inspections and prepare test reports:

Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.

Operational Test: After electrical circuitry has been energized, confirm proper operation.

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

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SECTION 15565

HEATING SYSTEM; GAS-FIRED HEATERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.66 (1996) Automatic Vent Damper Devices for Use with Gas-Fired Appliances

ANSI Z83.4 (1991; A 2002) Non-Circulating Direct Gas-Fired Industrial Air Heaters

ANSI Z83.6 (1990; A 1993) Gas-Fired Infrared Heaters

CANADIAN STANDARDS ASSOCIATION (CSA)

CSA Directory (Updated Continuously) Certified Products Listings

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2003) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211 (2000) Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances

NFPA 54 (2002) National Fuel Gas Code

UNDERWRITERS LABORATORIES (UL)

UL FCLGED (2003) Flammable and Combustible Liquids and Gases Equipment Directory

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Testing, Adjusting, and Balancing

Test reports shall be submitted in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

SD-10 Operation and Maintenance Data

Operation and Maintenance Instructions

Six complete copies of operating instructions outlining the step-by-step procedures required for system startup, operation and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and basic operating features. Six complete copies of maintenance instructions listing routine maintenance, possible breakdowns, repairs and troubleshooting guide. The instructions shall include simplified piping, wiring, and control diagrams for the system as installed.

1.3 GENERAL REQUIREMENTS

1.3.1 Nameplates

Each major component of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the equipment.

1.3.2 Verification of Dimensions

The Contractor shall become thoroughly familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

1.3.3 Detail Drawings

The Contractor shall submit detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operation of the system. Detail drawings for space heating equipment, controls, associated equipment, and for piping and wiring. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from weather, humidity and temperature variations, dirt and dust, or other contaminants.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Material and equipment shall be standard products of a manufacturer regularly engaged in manufacturing of the products. Equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

2.2 ELECTRICAL WORK

Electrical motor driven equipment shall be provided complete with motors, motor starters, and controls. Motors shall conform to NEMA MG 1. Electrical characteristics shall be as specified or indicated. Unless otherwise indicated motors of 1 Hp and above shall be high efficiency type.

Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control specified. Each motor shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided.

2.3 HEATERS

Heaters shall be equipped for and adjusted to burn natural gas. Each heater shall be provided with a gas pressure regulator that will satisfactorily limit the main gas burner supply pressure. Heaters shall have an intermittent or interrupted electrically ignited pilot or a direct electric ignition system. Safety controls shall conform to the ANSI standard specified for each heater. Mounting brackets and hardware shall be furnished by the heater manufacturer and shall be factory finished to match the supported equipment. Seismic details shall be in accordance with Sections 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT.

2.3.1 Direct Fired Make-Up Air Heaters

Heaters shall be in accordance with ANSI Z83.4. Direct fired make-up air heaters use outside air directly ducted to the heater. The products of combustion generated by the heater are released into the outside air stream being heated. Heaters shall be equipped with motorized inlet dampers, duct collar and air filters. Gas control valve shall be modulating type. Maximum air temperature rise during minimum burner fire shall be 7 degrees F.

Fan shall be variable speed. Motorized inlet dampers shall be closed when the unit is shut down. Dampers shall be interlocked to prevent burner operation when dampers are closed. Heaters shall be provided with a discharge air thermostat, a low limit air stream thermostat, and an ambient air thermostat. The space discharge air thermostat shall control the gas control valve. The low limit air stream thermostat shall shut down the entire unit if the discharge air temperature drops below the space thermostat setting. The ambient air thermostat shall shut down the burner if the outside air exceeds the discharge thermostat setting.

2.3.2 Direct Fired Make-Up Unit Accessories

2.3.2.1 Service Platform

Service platform constructed of structural steel shall be supplied for

field assembly. Platform shall have grated floor and safety chain at man entrance point. Platform shall be factory primed and painted in manufacturer's standard color scheme.

2.3.2.2 Variable Frequency Drive

The direct-fired make-up air unit shall be specifically designed for variable volume operation. The unit manufacturer shall provide a variable frequency drive for remote, field mounting.

The variable frequency drive (VFD) shall be enclosed in a NEMA-1 enclosure and be configured for wall mounting. The panel shall have key pad or touch screen for field adjustment of operating setpoints, manual override and operational status of unit. Include manual speed potentiometer, H-O-A, power light, drive run light.

The VFD shall have an input circuit breaker per UL 489 with a minimum of 10,000 amps symmetrical interrupting capacity. A converter stage per UL 508C shall change fixed voltage, fix frequency, AC line power to a fixed DC voltage. The convertor shall use a full wave bridge rectifier. The convertor shall be insensitive to 3-phase rotation of the AC line and shall not cause displacement power factor of less than 0.95 lagging under any speed or load condition.

An inverter stage shall change fixed DC voltage to variable frequency, variable voltage AC for motor speed control. The inverter shall be switched in a manner to produce a sinusoidal pulse width modulated output wave form.

An output wave form of 10 to 60 Hz is required. Minimum efficiency of VFD shall be 96% over full range of operation.

2.3.3 Infrared Heaters

Heaters shall conform to the requirements of ANSI Z83.6 and shall be vented type. Vented heaters shall be vented to the outside atmosphere. Heater style shall be tubular type. Reflector shape shall be parabolic as indicated. Heaters shall be provided with space thermostats which control the unit's burner. Thermostats located in the direct radiation pattern shall be covered with a metal shield.

2.4 THERMOSTATS

Thermostats shall be the adjustable electric or electronic type. Control wiring required to complete the space temperature control system shall be included. Thermostats shall have a 3 degree F differential and a set point range of 40 to 75 degrees F. Thermostats shall be the two stage type.

2.5 VENT PIPING

Vent piping shall conform to the requirements of NFPA 54. Plastic material polyetherimide (PEI) and polyethersulfone (PES) are forbidden to be used for vent piping of combustion gases.

2.6 INSULATION

Insulation for piping and equipment and application shall be in accordance with Section 15085 THERMAL INSULATION FOR PIPING SYSTEMS.

2.7 FACTORY FINISHES

Equipment and component items, when fabricated from ferrous metal, shall be factory finished with the manufacturer's standard finish.

PART 3 EXECUTION

3.1 INSTALLATION

Equipment shall be installed as indicated and in accordance with the recommendations of the equipment manufacturer and the listing agency, except as otherwise specified.

3.1.1 Heating Equipment

Heaters shall be installed with clearance to combustibles complying with minimum distances as determined by CSA Directory, UL FCLGED and as indicated on each heater approval and listing plate. Heaters shall be independently supported from the building structure as indicated and shall not rely on support from suspended ceiling systems.

3.1.2 Vents

Vent dampers, piping and structural penetrations shall be located as indicated. Vent damper installation shall conform to ANSI Z21.66. Vent pipes, where not connected to a masonry chimney conforming to NFPA 211, shall extend through the roof or an outside wall and shall terminate, in compliance with NFPA 54. Vents passing through waterproof membranes shall be provided with the necessary flashings to obtain waterproof installations.

3.1.3 Gas Piping

Gas piping shall be connected as indicated and shall comply with the applicable requirements at Section 15195 GAS PIPING SYSTEMS.

3.2 TESTING, ADJUSTING, AND BALANCING

Testing, adjusting, and balancing shall be as specified in Section 15950A TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS.

-- End of Section --

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SECTION 15720

AIR HANDLING UNITS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 430 (1999) Central-Station Air-Handling Units

ARI 880 (1998) Air Terminals

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 211 (1994) Certified Ratings Program - Air Performance

AMCA 99 (1991; AMCA 99-0401) Standards Handbook

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 51 (1999) Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

ASHRAE 52.1 (1992) Gravimetric and Dust Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter

ASTM INTERNATIONAL (ASTM)

ASTM A 653/A 653M (2003) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 1940-1 (2003) Mechanical Vibration - Balance Quality Requirements of Rigid Rotors - Part 1: Determination of Permissible Residual Unbalance

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

NEMA MG 1 (2002) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A (2002) Standard for the Installation of
Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 900 (1994; Rev thru Oct 1999) Standard for
Safety for Air Filter Units

1.2 GENERAL REQUIREMENTS

Section 15003 GENERAL MECHANICAL PROVISIONS applies to work specified in this section.

Equipment and Performance Data shall be submitted for air handling units in accordance with the specification. Data shall consist of use life, total static pressure and coil face area classifications, and performance ratings.

All drawings and manuals submitted shall include a spare parts data sheet, with manufactures recommended stock levels.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-03 Product Data

Equipment and Performance Data shall be submitted for air handling units in accordance with paragraph entitled, "General Requirements," of this section.

Manufacturer's catalog data shall be submitted for the following items:

Unit Cabinet
Fan
Drain Pans
Insulation

SD-07 Certificates

Listing of Product Installations shall be submitted for air handling units in accordance with paragraph entitled, "AHU Equipment Installation," of this section.

Certificates shall be submitted for following items showing conformance with the referenced standards contained in this section.

Unit Cabinet
Fan

Drain Pans
Insulation

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be submitted for air handling units in accordance with paragraph entitled, "Operation and Maintenance," of this section.

PART 2 PRODUCTS

2.1 AIR HANDLING UNIT (AHU)

Air handling unit (AHU) shall be central-station type, factory fabricated, and fully assembled. AHU shall include components and auxiliaries in accordance with ARI 430. AHU fan and motor shall be balanced to ISO 1940-1-1986, G6,3.

Total static pressure and coil face area classification shall conform to AMCA 99.

Fans with enlarged outlets shall not be permitted.

AHU fan shall be double-width, double-inlet, centrifugal scroll type.

2.2 UNIT CABINET

AHU cabinet shall be suitable for pressure class shown and shall have leaktight joints, closures, penetrations, and access provisions. Cabinet shall not expand or contract perceptibly during starting and stopping of fans and shall not pulsate during operation. Cabinet surfaces with deflections in excess of 0.004167 of unsupported span shall be reinforced prior to acceptance. Pulsating panels, which produce low frequency noise due to diaphragming of unstable panel walls, shall be stiffened to raise natural frequency to an easily attenuated level. Enclosure shall be fabricated from continuous hot-dipped galvanized steel no lighter than 20 gage thickness, to match industry standard. Mill-galvanized sheet metal shall conform to ASTM A 653/A 653M and shall be coated with not less than 1.25 ounces of zinc per square foot of two-sided surface. Mill-rolled structural steel shall be hot-dip galvanized or primed and painted. Cut edges, burns, and scratches in galvanized surfaces shall be corrosion protected. Primed and painted black carbon steel cabinet construction shall comply with this specification.

Provide removable panels to access the interior of the unit cabinet. All seams shall be welded, bolted or gasketed and sealed with a rubber-based mastic. Entire floor as well as ceiling unit shall be hot-dipped galvanized steel. Provide removable access doors on both sides of all access, filter, and fan sections for inspection and maintenance.

Exterior surfaces of cabinets constructed of mill-galvanized steel shall be left unpainted and painted with two coats of manufacturer's standard enamel finish in color selected by the Contracting Officer.

Cabinets and casings shall be double walled with 1 inch insulation. Interior wall shall be galvanized.

Fan wheels shall be dynamically and statically balanced at the factory. Maximum fan RPM shall be 25 percent less than the first critical speed. Fan shaft shall be solid, ground and polished steel and coated with a rust inhibitor. V-belt driven fans shall be designed for 50 percent overload capacity. Variable air volume air handling units that shall be provided with variable frequency drives shall have their fans balanced over the entire range of operation (20 percent - 100 percent RPM). Balancing fans of only 100 percent design of RPM shall not be acceptable for air handling units to be used with variable frequency drives.

Mount fans on isolation bases. Internally mount motors on same isolation bases and internally isolate fans and motors with 2-inch. Install flexible canvas ducts or vibration absorbent fan discharge seal between fan and casings to ensure complete isolation. Flexible canvas ducts shall comply with NFPA 90A.

Weigh fan and motor assembly at air handling unit manufacturer's factory for isolator selection. Statically and dynamically balance fan section assemblies. Fan section assemblies include fan wheels, shafts, bearings, drives, belts, isolation bases and isolators. Allow isolators to free float when performing fan balance. Measure vibration at each fan shaft bearing in horizontal, vertical and axial directions.

Factory install all motors on slide bases to permit adjustment of belt tension.

Fan motors shall be heavy duty, open drip-proof, operable at 208 volts, 60 hertz, 3-phase. All motors shall be high efficiency. Refer to specification Section 16286 OVERCURRENT PROTECTIVE DEVICES.

2.3 FAN

Overall fan-section depth shall be equal to or greater than the manufacturer's free-standing fan.

Fans shall be single-wheel.

Location of fan inlet shall provide not less than one-half fan-wheel diameter clearance from cabinet wall or adjacent fan inlet where double wheels are permitted.

AHU fan motor and drive shall be installed inside fan cabinet. Motor shall conform to NEMA MG 1 and be installed on an adjustable base. An access door of adequate size for servicing motor and drive shall be provided. A belt guard shall be provided inside the cabinet, or the access door shall be interlocked with the supply fan so that power to the fan will be interrupted when the access door is opened.

2.4 DRAIN PANS

Integral cabinet drain pan shall extend under all areas where condensate

must be collected and shall be watertight with welded or brazed joints, piped to drain, corrosion protected in condensate collection area, and insulated against sweating. Sheet metal shall be minimum 14-gage, except that 16-gage double-drain-pan construction shall be acceptable.

Cooling coil ends shall be enclosed by cabinet and shall be factory insulated against sweating or shall drain to a drain pan.

All drain pans shall be double pan construction, thermally isolated from the exterior casing with 1-inch thick fiberglass insulation. All drain pans shall slope to drain and shall drain substantially dry by gravity alone when drains are open.

All pans shall have a double slope to the drain point.

2.5 INSULATION

Unit shall be insulated with 1-inch, 1-1/2 pound density neoprene coated fiberglass insulation. Material shall be applied to the cabinet with waterproof adhesives and permanent fasteners on 100 percent coverage basis. Adhesive and insulating material shall be in accordance with NFPA 90A.

2.6 COILS

2.6.1 Coil Section

Coil section shall encase cooling coils and drain pipes. Coils shall be arranged for horizontal air flow. Provide intermediate drain pans for multiple coils installation. Coil headers shall be completely enclosed with the insulated casing with only connections extended through the cabinet. Refrigerant coil shall be two-circuit, fully intertwined type

2.6.2 Coil Pressure and Temperature Ratings

Coils shall be designed for the following fluid operating pressures and temperatures:

<u>SERVICE</u>	<u>PRESSURE</u>	<u>TEMPERATURE</u>
Hot Water	200 PSI	250 degrees F
Refrigerant	200 PSI	40 degrees F
<u>SERVICE</u>	<u>PRESSURE</u>	<u>TEMPERATURE</u>
Hot Water	289 Pa	121 degrees C
Refrigerant	289 Pa	4 degrees C

Coils shall be air-pressure tested under water at the following minimum pressures:

<u>SERVICE</u>	<u>PRESSURE</u>
Water (hot and refrigerant)	250 PSI

SERVICEPRESSURE

Water (hot and refrigerant)

289 Pa

2.6.3 Hot Water Coils

Heating coils shall have copper tubing and aluminum fins.

2.6.4 Drainable Coils

Drainable coils shall be capable of being purged free of water with compressed air.

Self-draining coils shall have a drain point at the end of every tube and shall be pitched to that point. Drain provisions shall include: drained headers; U-bends with integral plugs; or nonferrous plugs in cast-iron headers. Each tube shall drain substantially dry by gravity alone when drains and vents are open.

2.7 FILTERS

2.7.1 Filter Housing

Provide factory fabricated filter section of the same construction and finish as unit casings. Filter sections shall have filter guides and full height, double wall, hinged and removable access doors for filter removal. Provide air sealing gaskets to prevent air bypass around filters. Provide visible identification on media frames showing model number and airflow direction. Where filter bank is indicated or required, provide means of sealing to prevent bypass of unfiltered air. Performance in accordance with ASHRAE 52.1.

2.7.2 Replaceable Air Filters

UL 900, Class 1, those which, when cleaned, do not contribute fuel when attacked by flame and emit only negligible amount of smoke. Permanent frames with replaceable media, 2-inch thickness and size as indicated or required.

2.7.3 Air Filter Gauges

Provide manometer air filter gauges of the inclined tube differential type, of solid acrylic plastic construction with built-in level vial and with an adjustable mirror-polished scale. Gauges shall be equipped with vent valves for zeroing and over-pressure safety traps. Gauge range shall be adequate for the particular installation. Gauges shall be as manufactured by Dwyer or approved equal.

Provide one (1) air filter gauge at each filter bank.

PART 3 EXECUTION

3.1 AHU EQUIPMENT INSTALLATION

Equipment shall be installed in accordance with manufacturer's recommendations.

Installation drawings shall be in accordance with referenced standards in this section.

3.2 AHU TESTING

AHU and components shall be performance tested and rated in accordance with AMCA 211 and ASHRAE 51. AHU ratings shall be in accordance with ARI 430.

Final test reports shall be provided to the Contracting Officer. Reports shall have a cover letter/sheet clearly marked with the System name, Date, and the words "Final Test Reports - Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database."

Air handling unit start-up shall be performed in the presence of the Contracting Officer.

3.3 OPERATION AND MAINTENANCE

Contractor shall submit Operation and Maintenance Manuals prior to testing the air handling units. Data shall be updated and resubmitted for final approval no later than 30 calendar days prior to contract completion.

3.4 COORDINATION

Contractor shall coordinate the size and location of concrete equipment pads, variable frequency drives, control and electrical requirements.

3.5 TEMPORARY CONSTRUCTION FILTERS

Temporary construction filters shall be in place during normal building construction whenever the air handling units are run for general ventilation, building dehumidification, and for other purposes during construction. Install two (2) layers of blanket filter at a time. Replace temporary construction filters as required during construction and after completion of duct system cleaning.

After systems have been cleaned and temporary construction filters are removed, and before test and balance operations are started, install set of final filters. Final filters shall not be in place while general building construction is taking place, to avoid unnecessary loading with construction dust. Clean permanent filter bank before testing and balancing.

All required installation, Fabrication and Connection drawings shall be submitted and approved prior to the start of work detailed on these drawings.

Maximum number of coil rows shall be four (4). Maximum number of fins per inch shall be ten (10).

VAV terminal units shall be ARI 880 certified and UL listed.

-- End of Section --

SECTION 15764

BLOWER-COIL UNITS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI S12.23 (1989; R 2001) Method for the Designation of Sound Power Emitted by Machinery and Equipment

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 1940-1 (2003) Mechanical Vibration - Balance Quality Requirements of Rigid Rotors - Part 1: Determination of Permissible Residual Unbalance

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

NEMA MG 1 (2002) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A (2002) Standard for the Installation of Air Conditioning and Ventilating Systems

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD 810 (Rev F; 2000) Department of Defense Test Method Standard for Environmental Engineering Considerations and Laboratory Tests

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Material, Equipment, and Product Installation Lists shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

SD-02 Shop Drawings

Fabrication Drawings shall be submitted for fan coil units in accordance with paragraph entitled, "General Requirements," of this section.

Installation Drawings shall be submitted for fan coil systems in accordance with the paragraph entitled, "Installation," of this section.

SD-03 Product Data

Equipment and Performance Data shall be submitted for fan coil units in accordance with paragraph entitled, "General Requirements," of this section.

Manufacturer's catalog data shall be submitted for the following items:

- Coils
- Casing
- Enclosure
- Motors
- Fan
- Drain Pans
- Filters

SD-04 Samples

Manufacturer's Standard Color Chart shall be submitted for fan coil units in accordance with paragraph entitled, "General Requirements," of this section.

SD-07 Certificates

Listing of Product Installations shall be submitted for fan coil units in accordance with paragraph entitled, "Installation," of this section.

Certificates shall be submitted for following items showing conformance with the referenced standards contained in this section.

- Coils
- Casing
- Enclosure
- Motors
- Fan
- Drain Pans
- Filters

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be submitted in accordance

with paragraph entitled, "Operation and Maintenance," of this section.

1.3 GENERAL REQUIREMENTS

Section 15003 GENERAL MECHANICAL PROVISIONS applies to work specified in this section.

Section 16225 MOTORS applies to this section.

Fabrication Drawings shall be submitted for fan coil units consisting of fabrication and assembly details to be performed in the factory.

Material, Equipment, and Product Installation Lists shall include the manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site information.

Equipment and Performance Data shall be submitted for fan coil units consisting of use life, system functional flows, safety features, and mechanical automated details. Curves indicating tested and certified equipment response and performance characteristics shall also be submitted, including vibration isolation.

Manufacturer's Standard Color Chart shall indicate the manufacturer's standard color selections and finishes for fan coil units.

PART 2 PRODUCTS

2.1 GENERAL

Base unit shall be complete with galvanized casing, water-coil assembly with auxiliary water heating-coil, valve and piping package, drain pans, air filter, fan motor, and motor control. Sound-power-level, decibels reference, 10 to the minus 12 power watt, at the fan operating speed selected to meet the specified capacity, shall not exceed the following values at the midfrequency of each octave band:

	<u>OCTAVE BANDS</u>				
	3RD	4TH	5TH	6TH	7TH
Frequency (hertz)	250	500	1,000	2,000	4,000
Power Level (decibels)	60	55	53	50	48

Sound-power-level data or values for these units shall be obtained in accordance with the test procedures specified in ANSI S12.23. Sound-power values apply to units provided with factory-fabricated cabinet enclosures and standard grilles. Values obtained for the standard cabinet models will be acceptable for concealed models without separate tests provided there is no variation between models as to the coil configuration, blowers, motor speeds, or relative arrangement of parts. Each unit shall be suspended

securely to the building structure. Capacity of the units shall be as indicated.

2.2 CASING

Casing shall be acoustically and thermally insulated internally with not less than 1/2-inch thick insulation conforming to NFPA 90A, fastened with waterproof and fire-resistant adhesive.

2.3 FAN

Fan shall be galvanized steel or aluminum, centrifugal type with FC blades.

In lieu of metal, wheels and scrolls shall be fabricated or molded from suitably reinforced nonmetallic compounds certified to have satisfactorily passed the low temperature, high temperature, temperature shock, and sand and dust tests for ground equipment, outlined in MIL-STD 810, without deformation, cracking, corrosion, or loss of balance characteristics. All surfaces shall be smooth. Assemblies shall be accessible for maintenance. Disassembly and reassembly shall be by mechanical fastening devices, not adhesives. Fan shall be balanced dynamically and statically to ISO 1940-1 at the factory, after assembly in unit.

2.4 COILS

Water coils shall be constructed of not less than 1/2-inch outside diameter (od) seamless copper tubing with copper or aluminum plate fins mechanically bonded or soldered to the tubes and shall be provided with not less than 5/8-inch od female solder connectors, accessory piping package with terminal connections for control valves, and manual air vent on returns. Provisions shall be made for coil removal.

2.5 DRAIN PANS

Drain pans shall be sized and located to collect condensed water dripping from any item within the unit enclosure. Drain pans shall be constructed of not lighter than 20-gage galvanized steel, thermally insulated to prevent condensation. Thermal insulation shall be coated with a waterproofing compound. Not less than 3/4-inch National Pipe Thread (NPT) copper drain connection shall be provided in the drain pan. Pans shall slope not less than 1/8-inch per foot to drain.

2.6 FILTERS

Filters shall be provided for each unit and shall be glass fiber throwaway or permanent washable type, 2-inch pleated (30 percent) throw away type. Filters shall be removable without tools.

2.7 MOTORS

Motors shall be direct connected, two-bearing, permanent split-capacitor type with built-in overload protection, conform to NEMA MG 1, and shall be mounted on a resilient base. Motors shall be designed for 1,060 revolutions per minute maximum on 115-volt, single-phase, 60-hertz power. Motors shall be furnished with three built-in speeds, with four insulated

leads (common, high, medium, and low) to terminate in a control-junction box. Motor shall be explosion proof and suitable for installation in Class I, Division 2, Group D locations as per NFPA 70.

A solid-state variable speed controller capable of not less than 50 percent speed reduction shall be provided in lieu of step speed control, when so specified.

2.8 INSULATION

All thermal and acoustical insulation shall be contained within a double walled enclosure or sealed with a coating which is impervious to moisture.

PART 3 EXECUTION

3.1 INSTALLATION

Equipment shall be installed as indicated and specified and in accordance with manufacturer's recommendations. Dampers shall be set in a fixed position to provide the outside air quantity scheduled.

Installation Drawings shall be submitted for fan coil systems in accordance with referenced standards in this section.

3.2 TESTS

Coils shall be hydrostatically tested at 250 pounds per square inch (psi) or under water at 250 psi air pressure and shall be suitable for 200-psi working pressure.

3.3 OPERATION AND MAINTENANCE

Contractor shall submit 6 copies of the Operation and Maintenance Manuals 30 calendar days prior to testing the fan coil units. Data shall be updated and resubmitted for final approval no later than 30 calendar days prior to contract completion.

-- End of Section --

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SECTION 15766

UNIT HEATERS AND CABINET HEATERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ASTM INTERNATIONAL (ASTM)

ASTM A 568/A 568M (2003) Standard Specifications for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for

ASTM F 1040 (1987; R 2001) Standard Specification for Filter Units, Air Conditioning, Viscous - Improvement and Dry Types, Replaceable

INTERNATIONAL CODE COUNCIL (ICC)

ICC IFGC (2003) International Fuel Gas Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture List shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

Listing of Product Installations

SD-02 Shop Drawings

As-built drawings shall be submitted for the following items providing current factual information including deviations from, and amendments, to the drawings and concealed and visible changes in the work.

Propeller Unit Heaters

Cabinet Unit Heaters

SD-03 Product Data

Equipment and performance data shall be submitted for the following items consisting of use life, system functional flows, safety features, and mechanical automated details. Curves indicating tested and certified equipment responses and performance characteristics shall also be submitted.

Propeller Unit Heaters
Cabinet Unit Heaters

Manufacturer's catalog data shall be submitted for the following items:

Casing
Fans
Motors
Propellers
Filters
Enclosures
Insulation
Vibration Isolation

SD-07 Certificates

Listing of Product Installations shall be submitted in accordance with paragraph entitled, "Installation," of this section.

Certificates shall be submitted for following items showing conformance with the referenced standards contained in this section.

Coils
Fans
Motors
Vertical Discharge Units
Horizontal Discharge Units
Propellers

SD-10 Operation and Maintenance Data

Contractor shall submit 6 copies of the Operation and Maintenance Manuals 30 calendar days prior to testing the following systems:

Propeller Unit Heaters
Cabinet Unit Heaters

Data shall be updated and resubmitted for final approval no later than 30 calendar days prior to contract completion.

1.3 MECHANICAL PROVISIONS

Section 15003 GENERAL MECHANICAL PROVISIONS applies to work specified in this section.

1.4 GENERAL REQUIREMENTS

Material, Equipment, and Fixture List shall include manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site information.

Records of Existing Conditions shall be submitted consisting of the results of Contractor's survey of work area conditions and features of existing structures and facilities within and adjacent to the jobsite. Commencement of work shall constitute acceptance of existing conditions.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

Spare parts list and information shall be submitted meeting referenced standards within this section.

2.1.1 Propeller Unit Heaters-Hot Water(PUH)

Drawings or schedule shall include capacity, heating media data and mounting height.

2.1.1.1 Type

Unit heaters shall be suspended type and arranged for discharge of air as indicated.

2.1.1.2 Coils

Heating elements shall be manufacturer's standard aluminum fin and shall be drainable and ventable.

2.1.1.3 Casings

Casings with smoothly contoured propeller orifice rings shall be constructed of 20-gage or thicker cold-rolled carbon steel. Casing surface finish shall include phosphate pretreatment, prime coating, and baked enamel finish.

2.1.1.4 Propellers and Motors

Propellers shall have not less than four aluminum blades and shall be dynamically balanced.

Horizontal-discharge units shall be provided with fan inlet safety guard.

2.1.1.5 Control

Unit heaters shall be controlled by line-voltage or low-voltage thermostats.

2.1.2 Cabinet Unit Heaters (CUH)

Drawings or schedule shall include capacity, power rating, heating media, filter, pressure drop, size, and other pertinent data.

2.1.2.1 Type

Cabinet unit heaters shall be quiet-operating type, complete with heating elements, fans and drives, filters, baffles and division walls, control provisions, and enclosures with access panels.

Cabinet shall not exceed drawing dimensions.

Unit pressure components shall be rated for service at not less than 150 psi at system working temperature.

2.1.2.2 Coils

Heating element shall be manufacturer's standard aluminum fin and shall be drainable and ventable.

Cataloged capacity of the heating element shall be constant and permanent.

Tube material shall be seamless deoxidized copper.

Fins shall be mechanically connected to the tubes. Loose fins at operating temperatures will be regarded as causing a reduction in capacity, and the Contractor shall replace all such material at no additional cost to the Government. Elements with bent or damaged fins are not acceptable.

Expansion provisions and supports shall be such that element movement is strainfree and noiseless.

2.1.2.3 Fan and Drive Assembly

Fan shall be centrifugal, forward-curved, double-width, double-inlet type, and shall be statically and dynamically balanced at the factory.

Fan drives shall be direct.

2.1.2.4 Filters

Filters shall be 1-inch minimum thickness, replaceable, throwaway type conforming to ASTM F 1040.

Filters shall be installed in a bypass-proof frame to ensure filtering of all moving air before entry into heating element and shall be removable without tools.

2.1.2.5 Enclosures

Enclosure construction shall be minimum 16-gage, cold-rolled carbon steel of stretcher-leveled quality conforming to ASTM A 568/A 568M. Construction shall have smooth, blemish-free surfaces, without sharp edges, and with

flush joints. Wrinkled-metal and notched-corner construction is not acceptable. Enclosure shall provide space for all riser pipes and controls. Access doors shall have tamperproof latches. Doors and panels shall be hinged to protect surface finishes and personnel.

Enclosure surface finish shall include manufacturer's standard phosphate pretreatment, prime coat, and baked enamel finish in color as selected by the Contracting Officer.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Equipment

Equipment shall be installed in accordance with manufacturer's recommendations.

3.1.2 Location

Heaters shall be installed in compliance with clearance and mounting height requirements of ICC IFGC and NFPA 70.

3.2 FIELD QUALITY CONTROL

Operational tests shall be conducted per manufacturer's instructions.

-- End of Section --

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SECTION 15815

LOW PRESSURE DUCTWORK

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 325 (2001) Manual of Steel Construction Load and Resistance Factor Design

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M (2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 36/A 36M (2003a) Standard Specification for Carbon Structural Steel

ASTM A 653/A 653M (2003) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A (2002) Standard for the Installation of Air Conditioning and Ventilating Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1481 (1995; 6th Ed) HVAC Duct Construction Standards - Metal and Flexible

UNDERWRITERS LABORATORIES (UL)

UL 181 (2003) UL Standards for Safety Factory-Made Air Ducts and Air Connectors

UL 555 (2002) UL Standard for Safety Fire Dampers

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists shall be submitted for low pressure ductwork systems in accordance with paragraph entitled, "General Requirements," of this section.

SD-02 Shop Drawings

The following shall be submitted for low pressure ductwork systems in accordance with paragraph entitled, "Design Requirements," of this section.

As-Built Drawings

SD-03 Product Data

Design Analysis and Calculations shall be submitted for low pressure ductwork systems in accordance with paragraph entitled, "Design Requirements," of this section.

Manufacturer's catalog data shall be submitted for the following items:

- Galvanized Steel Ductwork Materials
- Flexible Duct Materials
- Flexible Connectors
- Fire Dampers and Wall Collars
- Gravity Backdraft and Relief Dampers
- Manual Volume Dampers
- Louvers
- Roof Hoods

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be provided for:

- Fire Dampers and Wall Collars

1.3 PERFORMANCE REQUIREMENTS

Section 15003 GENERAL MECHANICAL PROVISIONS applies to work specified in this section.

1.4 DESIGN REQUIREMENTS

Low-pressure systems shall encompass ductwork and plenums where maximum air velocity is 2,000 feet per minute(fpm) and maximum static pressure is 2 inches water gage (wg), positive or negative.

1.5 GENERAL REQUIREMENTS

Records of Existing Conditions shall be submitted consisting of the results of Contractor's survey of work area conditions and features of existing

structures and facilities within and adjacent to the jobsite. Commencement of work shall constitute acceptance of existing conditions.

Material, Equipment, and Fixture Lists shall include the manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site information.

PART 2 PRODUCTS

2.1 GALVANIZED STEEL DUCTWORK MATERIALS

Galvanized steel ductwork sheet metal shall be carbon steel, of lock-forming quality, hot-dip galvanized, with regular spangle-type zinc coating, conforming to ASTM A 653/A 653M, G235. Duct surfaces to be painted shall be treated by phosphatizing.

Sheet metal gages and reinforcement thickness shall conform to SMACNA 1481, except for minimum standards stated herein.

MINIMUM SHEET METAL GAGE

<u>DUCT WIDTH</u> <u>INCHES</u>	<u>GAGE</u>
0 - 12	26
13 - 30	24
31 - 60	22

2.1.1 Duct Hangers

Duct hangers in contact with galvanized duct surfaces shall be galvanized steel painted with inorganic zinc.

2.1.2 Mill-Rolled Reinforcing and Supporting Materials

Mill-rolled structural steel shall conform to ASTM A 36/A 36M and, whenever in contact with sheet metal ducting, shall be galvanized in accordance with ASTM A 123/A 123M.

Equivalent strength, proprietary-design, rolled-steel structural support systems may be submitted for approval in lieu of mill-rolled structural steel.

2.2 FLEXIBLE DUCT MATERIALS

Flexible duct connectors shall be in accordance with UL 181, Class 1 material and shall comply with NFPA 90A.

Wire-reinforced cloth duct shall consist of a vinyl-impregnated and coated fibrous-glass cloth bonded to and supported by a corrosion-protected spring steel helix. Fabric may be a laminate of metallic film and fibrous glass. Working pressure rating of ducting shall be not less than three times maximum system pressure, and temperature range shall be minus 20 to plus 175 degrees F.

2.3 MANUAL VOLUME DAMPERS

Volume damper construction shall conform to SMACNA 1481.

Dampers shall be equipped with an indicating quadrant regulator with a locking feature externally located and easily accessible for adjustment. Where damper rod lengths exceed 30 inches, a regulator shall be provided at each end of damper shaft.

All damper shafts shall have two-end bearings.

Splitter damper shall be 22-gage sheet metal. Hinges shall be full length piano-type.

Damper shaft shall be full length and shall extend beyond damper blade. A 3/8 inch square shaft shall be used for damper lengths up to 20 inches and a 1/2 inch square shaft shall be used for damper lengths 20 inches and larger. Where necessary to prevent damper vibration or slippage, adjustable support rods with locking provisions external to duct shall be provided at damper blade end.

Dampers in ducts having a width perpendicular to the axis of the damper that is greater than 12 inches shall be multiblade type having a substantial frame with blades fabricated of 16-gage metal. Blades shall not exceed 10 inches in width and 48 inches in length and shall be pinned to 1/2 inch diameter shafts. Dampers greater than 48 inches in width shall be made in two or more sections with intermediate mullions, each section being mechanically interlocked with the adjoining section or sections. Blades shall have oil-impregnated sintered bronze bearings and shall be connected so that adjoining blades rotate in opposite directions.

2.4 GRAVITY BACKDRAFT AND GRAVITY RELIEF DAMPERS

Frame shall be constructed of not less than 1-1/2- by 4 inch reinforced 16-gage galvanized carbon steel. Frames and mullions shall be solidly secured in place and sealed with elastomer calking against air bypass.

Maximum blade width shall be 9 inches, and maximum blade length shall be 36 inches. Blade material shall be 16-gage galvanized steel. Blades shall be provided with mechanically retained seals and 90-degree limit stops.

Dampers used for relief service shall have blades linked together to open not less than 30 degrees on 0.05 inch wg differential pressure.

Shaft bearings shall be oil-impregnated bronze.

Counterbalanced dampers shall be equipped with fixed or adjustable counterbalancing weights.

Gravity backdraft dampers in sizes 18 by 18 inches or smaller, when furnished integral with air moving equipment, may be equipment manufacturer's standard construction.

2.5 PRESSURE RELIEF DOORS

Frame and door constructed of 12 gauge galvanized steel, polyurethane foam door seal, negator springs for door closure or opening. Designed for positive or negative pressure applications as indicated on drawings.

2.6 LOUVERS

Provide extruded aluminum louvers with baked enamel finish. Color as per Architectural specifications to match Base standard colors. Louver shall be constructed of aluminum extrusions, ASTM B 221, alloy 6063-T52. Weld units or provide stainless steel fasteners. Provide 1/2-inch square mesh anodized aluminum bird screen. Provide concealed horizontal and vertical mullions and preformed extended sills.

2.7 ROOF HOODS

Constructed of 14 gauge steel with bolted and welded aluminum. Support structure shall be a minimum of 10 gauge aluminum. The aluminum base shall be continuously welded for exterior installations. Provide 1/2-inch square mesh anodized aluminum bird screen and roof curb matching pitch of roof with a minimum height of 12 inches above highest roof.

2.8 FLEXIBLE CONNECTORS FOR SHEET METAL

Connectors shall be UL-listed, 20-ounce, fire-retardant, airtight, woven fibrous-glass cloth impregnated with chloroprene. Clear width, not including clamping section, shall be 3 to 3 inches.

2.9 FIRE DAMPERS AND WALL COLLARS

Fire damper locations shall be in accordance with NFPA 90A.

Fire dampers in ductwork shall be provided at firewall barriers.

Fire dampers shall be constructed and labeled in accordance with UL 555 to provide damper and mounting fire-resistance that equals or exceeds fire-resistance of the construction in which installed. For link loads in excess of 20 pounds, UL-approved quartzoid links shall be provided.

Wall collars shall be constructed in accordance with UL 555.

PART 3 EXECUTION

3.1 INSTALLATION

Sheet metal construction shall be provided in accordance with the SMACNA 1481 and NFPA 90A.

Supplementary steel shall be designed and fabricated in accordance with AISC 325.

Fabrication shall be airtight and shall include necessary reinforcements, bracing, supports, framing, gasketing, sealing, and fastening to provide

rigid construction and freedom from vibration, airflow-induced motion, noise, and excessive deflection at specified maximum system air pressure.

Dampers located behind architectural intake or exhaust louvers shall be enclosed by a rigid sheet metal collar and sealed to building construction with elastomers for complete air tightness.

Outside air-intake ducts and plenums shall be sheet metal and shall have soldered watertight joints.

Offsets and transformations shall be provided as required to avoid interference with the building construction, piping, or equipment.

Wherever ducts pass through firewalls or through walls or floors dividing conditioned spaces from unconditioned spaces, a flanged segment shall be provided in that surface during surface construction.

Sheet metal surfaces to be painted or surfaces to which adhesives will be applied shall be clean and free of oil, grease, and deleterious substances.

Where interiors of ducting may be viewed through air diffusion devices, the viewed interior shall be sheet metal and shall be painted flat black.

Duct strength shall be adequate to prevent failure under pressure or vacuum created by fast closure of ductwork devices. Leaktight automatic relief devices shall be provided.

3.2 RECTANGULAR SHEET METAL DUCTS

Standard seam joints shall be sealed with an elastomer compound to comply with SMACNA 1481 Seal Class A, B or C as applicable.

Crossbreaking shall be limited to 4 feet and shall be provided on all ducts 8 inches wide and wider. Bead reinforcement shall be provided in lieu of crossbreaking where panel popping may occur. Where rigid insulation will be applied, crossbreaking is not required.

3.2.1 Longitudinal Duct Seams

Corner seams shall be Pittsburgh lock.

3.2.2 Joints and Gaskets

Companion angle flanges shall be bolted together with 1/4 inch diameter bolts and nuts spaced 6 inches on center. Flanged joints shall be gasketed with chloroprene full-face gaskets 1/8 inch thick, with Shore A 40 durometer hardness. Gaskets shall be one piece and dovetailed at joints.

3.2.3 Flexible Duct Joints

Joints between flexible duct without sheet metal collars and round metal ductwork connections shall be made by trimming the ends, coating the inside of the flexible duct for a distance equal to depth of insertion with elastomer calk, and by securing with sheet metal screws or binding with a

strap clamp.

3.2.4 Square Elbows

Single-vane duct turns shall be provided in accordance with SMACNA 1481, and may be used on ducts 12 inches wide and narrower.

3.2.5 Radius Elbows

Radius elbows shall conform to SMACNA 1481. Radius elbows shall have an inside radius equal to the width of the duct. Where installation conditions preclude use of standard elbows, the inside radius may be reduced to a minimum of 0.25 times duct width and turning vanes shall be installed in accordance with the following schedule.

WIDTH OF ELBOWS INCHES	RADIUS OF TURNING VANES IN PERCENT OF DUCT WIDTH		
	VANE NO. 1	VANE NO. 2	VANE NO. 3
Up to 16	56	--	--
17 to 48	43	73	--
49 and over	37	55	83

Where two elbows are placed together in the same plane in ducts 30 inches wide and larger, the guide vanes shall be continuous through both elbows rather than spaced in accordance with above schedule.

3.2.6 Outlets, Inlets, and Duct Branches

Branches, inlets, and outlets shall be installed so that air turbulence will be reduced to a minimum and air volume properly apportioned. Adjustable splitter dampers shall be installed at all supply junctions to permit adjustment of the amount of air entering the branch. Wherever an air-diffusion device is shown as being installed on the side, top, or bottom of a duct, and whenever a branch takeoff is not of the splitter type, a commercially manufactured air extractor shall be provided to allow adjustment of the air quantity and to provide an even flow of air across the device or duct it services.

Where a duct branch is to handle 25 percent or less of the air handled by the duct main, the branch connection shall have a 45 degree side take-off entry in accordance with SMACNA 1481 Fig 2-6.

3.2.7 Duct Transitions

Where the shape of a duct changes, the angle of the side of the transition piece shall not exceed 15 degrees from the straight run of duct connected thereto.

Where equipment is installed in ductwork, the angle of the side of the transition piece from the straight run of duct connected thereto shall not exceed 15 degrees on the upstream side of the equipment and 22-1/2 degrees

on the downstream side of the equipment.

3.2.8 Branch Connections

Radius tap-ins shall be constructed in accordance with SMACNA 1481.

3.2.9 Access Openings

Access doors and panels shall be installed in ductwork upstream from coils, adjacent to fire dampers at controls, or at any item requiring periodic inspection, adjustment, maintenance, or cleaning and every 20 feet 6.1M for indoor air quality housekeeping purposes.

Minimum size of access opening shall be 12 by 18 inches , unless precluded by duct dimensions or otherwise indicated.

Access door construction shall be in accordance with SMACNA 1481, except that sliding doors may be used only for special conditions upon prior approval. Insulated doors shall be double-panel type.

Access doors that leak shall be made airtight by adding or replacing hinges and latches or by construction of new doors adequately reinforced, hinged, and latched.

Duct access shall be particularly suitable for commercial duct cleaning methods utilizing vacuum devices. Access openings shall be spaced with a frequency and at points which will permit ready access to duct internals with essentially no duct or insulation cutting. Where access through an air-diffusion device or through access doors specified herein is not available at a specific point, 8 inch diameter, 16-gage access plates shall be provided not more than 10 feet on center. Where duct is insulated and vapor-sealed, mastic seals shall be provided around circumference of access. When access plate is in place and insulated, the location shall be externally identified.

3.2.10 Duct Supports

Selection of hanging system shall be at the Contractor's option. The following support sizes, configurations, and spacings are given to show the minimal type of supporting component required. Where installed loads are excessive for the specified hanger spacings, hangers, and accessories, heavier-duty components shall be provided. After system startup, any duct support device which, due to length, configuration, or size, vibrates or causes possible failure of a member or damage to ducting shall be replaced or the condition shall be alleviated.

Hanger rods, angles, and straps shall be attached to beam clamps. Concrete inserts and masonry anchors and fasteners shall be approved for the application.

Where support from metal deck systems is required, support requirements shall be coordinated with installation of metal deck.

Ductwork and equipment shall not be hung from roof deck, piping, or other

ducts or equipment. Maximum span between any two points shall be 10 feet with lesser spans for duct assemblies, interferences, and loads imposed or permitted.

There shall be not less than one set of hangers for each point of support. Hangers shall be installed on both sides of all duct turns, branch fittings, and transitions.

Hangers shall be sufficiently cross-braced to eliminate vertical and lateral sway.

Perforated strap hangers shall not be acceptable.

Rectangular ducting, 36 inches and larger, shall be supported by trapeze hangers. Ducts situated in unconditioned areas and required to have insulation with a vapor-sealed facing shall be supported on trapeze hangers. Hangers shall be spaced far enough out from the side of the duct to permit the duct insulation to be placed on the duct inside of the trapeze. Under no circumstances shall duct hangers penetrate the vapor-sealed facing.

Where trapeze hangers are used, the bottom of the duct shall be supported on angles sized as follows:

<u>WIDTH OF DUCT, INCHES</u>	<u>MINIMUM BOTTOM ANGLE SIZE, INCHES</u>
30 and smaller	1-1/4 by 1-1/4 by 1/8
31 to 48	1-1/2 by 1-1/2 by 1/8
49 to 72	1-1/2 by 1-1/2 by 3/16
73 to 96	2 by 2 by 1/4
97 and larger	3 by 3 by 1/4

Where ductwork system contains heavy equipment, excluding air-diffusion devices and single-leaf dampers, such equipment shall be hung independently of the ductwork by means of rods or angles of sizes adequate to support the load.

Ducting supported from roof purlins shall be supported at points not greater than one-sixth of the purlin span from the roof truss. Load per hanger shall not exceed 400 pounds when support is from a single purlin or 800 pounds when hanger load is applied halfway between purlins by means of auxiliary support steel provided under this section. When support is not halfway between purlins, the allowable hanger load shall be the product of 400 times the inverse ratio of the longest distance to purlin-to-purlin spacing.

When the hanger load exceeds the above limits, reinforcing of purlin(s) or additional support beam(s) shall be provided. When an additional beam is used, the beam shall bear on the top chord of the roof trusses and bearing shall be over gusset plates of top chord. Beam shall be stabilized by

connection to roof purlin along bottom flange.

Purlins used for supporting fire-protection sprinkler mains, electrical lighting fixtures, and electrical power duct or cable tray shall be considered fully loaded, and supplemental reinforcing or auxiliary support steel to support ductwork shall be provided for these purlins.

3.3 MANUAL VOLUME DAMPERS

Balancing dampers of the splitter, butterfly, or multilouver type, shall be provided to balance each respective main and branch duct.

Dampers regulated through ceilings shall have regulator concealed in box mounted in the ceiling, with a cover finish aesthetically compatible with ceiling surface. Where ceiling is of removable construction, regulators shall be above ceiling, and location shall be marked on ceiling in a manner acceptable to the Contracting Officer.

3.4 FLEXIBLE CONNECTORS FOR SHEET METAL

Air handling equipment, ducts crossing building expansion joints, and fan inlets and outlets shall be connected to upstream and downstream components by treated woven-cloth connectors.

Connectors shall be installed only after system fans are operative, and vibration isolation mountings have been adjusted. When system fans are operating, connectors shall be free of wrinkle caused by misalignment or fan reaction. Width of surface shall be curvilinear.

3.5 INSULATION PROTECTION ANGLES

Galvanized 20-gage sheet steel, formed into an angle with a 2 inch exposed long leg with a 3/8 inch stiffening break at outer edge, and with a variable concealed leg, depending upon insulation thickness shall be provided.

Angles shall be installed over insulation edges terminating by butting against a wall, floor foundation, frame, and similar construction. Angles shall be fastened in place with blind rivets through the protection angle, insulation, and sheet metal duct or plenum. Angles shall be installed after final insulation covering has been applied.

3.6 DUCT PROBE ACCESS

Holes shall be provided with neat patches, threaded plugs, or threaded or twist-on caps where indicated, and where necessary, for air-balancing pitot tube access. Extended-neck fittings shall be provided where probe access area is insulated.

3.7 OPENINGS IN ROOFS AND WALLS

Openings indicated in outside walls and roof are approximate.

3.8 DUCTWORK CLEANING PROVISIONS

Open ducting shall be protected from construction dust and debris in a manner approved by the Contracting Officer. Dirty assembled ducting shall be cleaned by subjecting main and branch interior surfaces to air streams moving at velocities two times the specified working velocities, at static pressures within maximum ratings. Ducting shall be cleaned by a method approved by the Contracting Officer. Compressed air used for cleaning ducting shall be water- and oil-free. Prior to acceptance of the work, dust and debris shall be removed from exterior surfaces.

3.9 FIRE DAMPER TESTS

Operation tests shall be performed on each fire damper in the presence of the Contracting Officer by removing the fusible link and demonstrating the operation of the damper. New links shall be provided and installed after successful testing.

3.10 DUCTWORK LEAKAGE TESTS

Contractor shall conduct leakage test on new duct in accordance with Section 15950 TESTING, ADJUSTING AND BALANCING. Test shall be performed prior to installing ductwork insulation.

3.11 OPERATION AND MAINTENANCE

Operation and Maintenance Manuals shall be consistent with manufacturer's standard brochures, schematics, printed instructions, general operating procedures and safety precautions.

-- End of Section --

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SECTION 15818

MEDIUM/HIGH PRESSURE DUCTWORK

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 350 (1999) Load and Resistance Factor Design (LFRD) Specification for Structural Steel Buildings

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE-03 (1997) Handbook, Fundamentals (IP Edition)

ASHRAE-06 (1997) Handbook, HVAC Systems and Equipment (IP Edition)

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8 (1992; R 2003) Specification for Filler Metals for Brazing and Braze Welding

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M (2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 36/A 36M (2003a) Standard Specification for Carbon Structural Steel

ASTM A 653/A 653M (2003) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 924/A 924M (1999) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A (2002) Standard for the Installation of Air Conditioning and Ventilating Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION
(SMACNA)

SMACNA 1481 (1995; 6th Ed) HVAC Duct Construction
Standards - Metal and Flexible

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS 2480 (2001) Phosphate Treatment, Paint Base

1.2 DESIGN REQUIREMENTS

Section 15003, "General Mechanical Provisions," apply to work specified in this section.

Section 15055, "Welding Mechanical," applies to work specified in this section.

Equipment and Performance Data shall be submitted for medium/high pressure ductwork systems consisting of use life, system functional flows, safety features, and mechanical automated details. Curves indicating tested and certified equipment response and performance characteristics shall also be submitted.

Design Analysis and Calculations shall be submitted for medium/high pressure ductwork systems indicating the manufacturer's recommended air velocities, maximum static pressure, and temperature calculations.

1.3 SCOPE OF WORK

High velocity systems shall encompass ductwork where:

Minimum air velocity exceeds 2,000 feet per minute (fpm) or static pressure exceeds 2 inches water gage (wg).

Medium static pressure ranges from over 2 inches wg through 3 inches wg, positive or negative, or over 3 inches wg through 6 inches wg positive.

Refer to Section 15815 for pressure relief door specifications.

1.4 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists and Records of Existing Conditions shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

SD-02 Shop Drawings

The following shall be submitted in accordance with paragraph entitled, "Drawings," of this section.

As-Built Drawings

SD-03 Product Data

Equipment and Performance Data shall be submitted for medium/high pressure ductwork systems in accordance with paragraph entitled, "Design Requirements," of this section.

Manufacturer's catalog data shall be submitted for the following items:

- Galvanized Steel Ductwork Materials
- Brazing Materials
- Mill-Rolled Reinforcing and Supporting Materials
- Round Sheet Metal Duct Fittings
- Turning Vanes
- Dampers
- Flexible Connectors

SD-07 Certificates

Listing of Product Installations for medium/high pressure ductwork systems in accordance with paragraph entitled, "Installation," of this section.

Certificates shall be submitted, showing conformance with the referenced standards contained in this section for:

- Galvanized Steel Ductwork Materials
- Brazing Materials
- Mill-Rolled Reinforcing and Supporting Materials
- Round Sheet Metal Duct Fittings
- Round, High-Pressure, Double-Wall Sheet Metal Ducts
- Turning Vanes
- Dampers
- Flexible Connectors

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be submitted in accordance with paragraph entitled, "Operation and Maintenance," of this section.

1.5 GENERAL REQUIREMENTS

Records of Existing Conditions shall be submitted consisting of the results of Contractor's survey of work area conditions and features of existing structures and facilities within and adjacent to the jobsite. Commencement of work shall constitute acceptance of existing conditions.

Material, Equipment, and Fixture Lists shall include the manufacturer's

style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site information.

1.6 DRAWINGS

As-Built Drawings shall provide current factual information including deviations from, and amendments to, the drawings and concealed or visible changes in the work, for medium/high pressure ductwork systems.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Galvanized Steel Ductwork Materials

Galvanized steel ductwork sheet metal shall be carbon steel, of lock-forming quality, hot-dip galvanized, with regular spangle-type zinc coating, conforming to ASTM A 924/A 924M and ASTM A 653/A 653M, Designation G90. Duct surfaces to be painted shall be treated by phosphatizing.

Sheet metal gages and reinforcement thickness shall conform to ASHRAE-06, Chapter 16, ASHRAE-03, Chapter 32 and SMACNA 1481.

2.1.2 Brazing Materials

Brazing materials shall be silicon bronze conforming to AWS A5.8.

2.1.3 Mill-Rolled Reinforcing and Supporting Materials

Mill-rolled structural steel shall conform to ASTM A 36/A 36M and, wherever in contact with sheet metal ducting, shall be galvanized to commercial weight of zinc or coated with materials conforming to ASTM A 123/A 123M.

Equivalent strength, proprietary design, rolled-steel structural support systems may be submitted for approval in lieu of mill-rolled structural steel.

2.2 COMPONENTS

2.2.1 Round Sheet Metal Duct Fittings

Fittings shall be shop fabricated.

Fittings shall be manufactured as separate fittings, not as tap collars welded or brazed into duct sections.

Offset configurations shall be submitted for approval.

Miter elbows shall be two-piece type for angles less than 31 degrees, three-piece type for angles 31 through 60 degrees, and five-piece type for angles 61 through 90 degrees. Centerline radius of elbows shall be 1-1/2 times fitting cross section diameter.

Crosses, increasers, reducers, reducing tees, and 90-degree tees shall be

conical type.

Cutouts in fitting body shall be equal to branch tap dimension or, where smaller, excess material shall be flared and rolled into smooth radius nozzle configuration.

2.2.2 Reinforcement

Inner liners of both duct and fittings shall be supported by metal spacers welded in position to maintain spacing and concentricity.

2.2.3 Fittings

Divided flow fittings shall be made as separate fittings, not tap collars into duct sections, with the following construction requirements:

Sound, airtight, continuous welds at intersection of fitting body and tap

Tap liner securely welded to inner liner, with weld spacing not to exceed 3 inches

Insulation shall be packed around the branch tap area for complete cavity filling.

Branch connection shall be carefully fit to cutout openings in inner liner without spaces for air erosion of insulation and without sharp projections that cause noise and airflow disturbance.

Seams in the pressure shell of fittings shall be continuously brazed. Galvanized areas that have been damaged by welding shall be protected with manufacturer's standard corrosion-resistant coating.

Offset configurations shall be submitted for approval.

Elbows shall be two-piece type for angles through 35 degrees, three-piece type for angles 36 through 71 degrees, and five-piece type for angles 72 through 90 degrees.

Crosses, increasers, reducers, reducing tees, and 90-degree tees shall be conical type.

2.2.4 Turning Vanes

Turning vanes shall be double-wall type, commercially manufactured for high-velocity system service.

2.2.5 Dampers

Low pressure drop, high-velocity manual volume dampers, and high-velocity fire dampers shall be constructed in accordance with ASHRAE-06, Chapter 16, ASHRAE-03, Chapter 32 and SMACNA 1481.

2.2.6 Flexible Connectors for Sheet Metal

Connectors shall be UL listed, 30-ounce per square foot, waterproof, fire-retardant, airtight, woven fibrous-glass cloth, double coated with chloroprene. Clear width, not including clamping section, shall be 6 to 8 inches.

PART 3 EXECUTION

3.1 PREPARATION

Sheet metal construction shall be provided in accordance with the recommendations for best practices in ASHRAE-06, Chapter 16, SMACNA 1481, NFPA 90A, and ASHRAE-03, Chapter 32.

Where construction methods for certain items are not described in the referenced standards or herein, the work shall be performed in accordance with recommendations for best practice defined in ASHRAE-06.

Sheet metal surfaces to be painted and surfaces to which adhesives are to be applied shall be clean and free of oil, grease, and deleterious substances.

Duct strength shall be adequate to prevent failure under service pressure or vacuum created by fast closure of duct devices. Leaktight, automatic relief devices shall be provided.

Supplementary steel shall be designed and fabricated in accordance with AISC 350.

3.2 INSTALLATION

Listing of Product Installations for medium/high pressure ductwork systems shall include identification of at least 5 units, similar to those proposed for use, that have been in successful service for a minimum period of 5 years. List shall include purchaser, address of installation, service organization, and date of installation.

Fabrication shall be airtight and shall include reinforcements, bracing, supports, framing, gasketing, sealing, and fastening to provide rigid construction and freedom from vibration, airflow-induced motion and noise, and excessive deflection at specified maximum system air pressure and velocity.

Where ducts pass through firewalls, a flanged duct segment with fire damper and access door shall be provided in that surface during surface construction.

3.3 APPLICATION

3.3.1 Rectangular Sheet Metal Ducts

3.3.1.1 Medium-Pressure Gages, Joints, and Reinforcement

Minimum sheet metal gages, joints, and reinforcements between joints shall

be in accordance with ASHRAE-06, Chapter 16, ASHRAE-03, Chapter 32 and SMACNA 1481.

3.3.1.2 Medium- and High-Pressure Branches, Inlets, Outlets

Branches, inlets, and outlets shall be installed to minimize air turbulence and to ensure proper airflow.

Dampers shall be installed so that the amount of air entering duct mains can be adjusted.

Commercially manufactured air extractors shall be provided to allow adjustment of the air quantity and to provide an even flow of air across the device or duct served.

Where a duct branch is to handle over 25 percent of the air handled by the duct main, a complete 90-degree increasing elbow shall be used, with an inside radius of 0.75 times duct branch width. Size of the trailing end of the increasing elbow within the main duct shall be in the same ratio to the main duct size as the ratio of the relative air quantities handled.

Where a duct branch is to handle 25 percent or less of the air handled by the duct main, the branch connection shall have an inside radius of 0.75 times branch duct width, a minimum arc length of 45 degrees, and an outside radius of 1.75 times duct branch width. Arc shall be tangent to duct main.

3.3.2 Round Sheet Metal Ducts

3.3.2.1 Duct Gages, Joints, and Reinforcement

Sheet metal minimum thickness, joints, and reinforcement between joints shall be in accordance with ASHRAE-06, Chapter 16, ASHRAE-03, Chapter 32 and SMACNA 1481.

Longitudinal duct joint shall be manufactured by machine, with spiral lockseams to and including 60 inch diameters, and to dimensional tolerances compatible with fittings provided.

Ducts shall have supplemental girth angle supports, riveted with solid rivets 6 inches on center tack welded to duct. Girth angles shall be located as follows:

<u>DIAMETER, INCHES</u>	<u>REINFORCEMENT-MAXIMUM SPACING, INCHES</u>
25 to 36	1-1/4 by 1-1/4, 1/8 thick, 72 inches on center

Draw band girth joints are not acceptable.

Slip joints shall be made up by coating the male fitting with elastomer sealing materials, exercising care to prevent mastic from entering fitting bore, leaving only a thin annular mastic line exposed internally. Sheet metal screws shall be used to make assembly rigid, not less than four

screws per joint, maximum spacing 6 inches. Pop rivets shall not be used. All joints shall be taped and heat sealed.

Bolt heads and nuts shall be hex-shaped, 5/16 inch diameter for ducts up to 50 inch diameter, and 3/8 inch diameter for 51 inch diameter ducts and larger.

Flanges shall be continuously welded to duct on outside of duct and intermittently welded with 1 inch welds every 4 inches on inside joint face. Excess filler metal shall be removed from inside face. Galvanized areas that have been damaged by welding shall be protected with manufacturer's standard corrosion-resistant coating.

3.3.2.2 Duct Transitions

Where the shape of a duct changes, the angle of the side of the transition piece shall not exceed 15 degrees from the straight run of duct connected thereto.

3.3.3 Round, High Pressure, Sheet Metal Duct Installation

3.3.3.1 Joints

An inner coupling shall be provided to align the inner lining to maintain good airflow conditions equivalent to standard round high-pressure duct joints. Butt joints are not suitable for the inner liner. This alignment shall be accomplished by extending the liner of the fitting for slip joint into the pipe. For ducts over 34 inches inside diameter, a separate coupling for inner alignment, with the pressure shells joined by angle-ring flanged connections, shall be provided.

3.3.3.2 Insulation Ends

At the end of an uninsulated section or run where internally insulated duct connects to uninsulated spiral duct, fitting, fire damper or flexible duct, an insulation end-fitting shall be installed to bring the outer pressure shell down to nominal size.

3.3.4 Transverse Reinforcement Joints

Transverse reinforcements shall be spot welded 4 inches on center. Transverse reinforcement shall be welded at all corners to form continuous frames.

3.3.5 Joint Gaskets

Flanged joints shall be gasketed with chloroprene full-face gaskets 1/8 inch thick, Shore A 40 durometer hardness. Gaskets shall be one piece, dovetailed at joints.

3.3.6 Radius Elbows

Elbow proportions and radius elbows shall be fabricated in accordance with ASHRAE-06, Chapter 16, ASHRAE-03, Chapter 32 and SMACNA 1481.

3.3.7 Access Openings

Access panels shall be installed in ductwork adjacent to fire dampers.

Minimum size of access opening shall be 12 by 18 inches, unless precluded by duct dimension.

Access openings shall be framed by welded and ground miter joint, 1/8 inch thick strap steel, with 1/4 inch studs welded to frame. Cover plate shall be not less than 16-gage, reinforced as necessary for larger sizes.

In lieu of access doors, readily accessible flanged duct sections may be provided upon approval. Stable hanger supports shall be provided for disconnected duct termini.

3.3.8 Duct Supports

Duct support shall be installed in accordance with ASHRAE-06, Chapter 16, ASHRAE-03, Chapter 32 and SMACNA 1481. Duct hangers shall meet the minimum size specified in ASHRAE-06, Chapter 16, ASHRAE-03, Chapter 32 and SMACNA 1481. Two hangers shall be provided where necessary to eliminate sway. Support attachment to duct surfaces, shall be by welding 4 inches on center.

Selection of hanging system shall be at the Contractor's option, and shall take into account the location and precedence of work under other sections, interferences of various piping and electrical conduit, equipment, building configuration, structural and safety factor requirements, vibration, and imposed loads under normal and abnormal service conditions. Support sizes, configurations, and spacings are given to show the minimal type of supporting components required. If installed loads are excessive for the specified hanger spacing, hangers, and accessories hanger spacing shall be reduced. After system startup, any duct support device which, due to length, configuration, or size, vibrates or causes possible failure of a member, shall be replaced or the condition shall otherwise be alleviated. Special care shall be exercised to preclude cascade-type failures.

Hanger rods, angles, and straps shall be attached to beam clamps. Concrete inserts, masonry anchors, and fasteners shall be approved for the application.

Hardened high-carbon spring-steel fasteners fitted onto beams and miscellaneous structural steel are acceptable upon prior approval of each proposed application and upon field demonstration of conformance to specification requirements. Fasteners shall be made from steel conforming to AISI Type 1070, treated and finished in conformance with SAE AMS 2480, Type Z (zinc phosphate base), Class 2 (supplementary treatment). A 72-hour load-carrying capacity shall be verified by a certified independent laboratory.

Hanger spacing shall provide a 20-to-1 safety factor for supported load.

Maximum load supported by any two fasteners shall be 100 pounds.

Friction rod assemblies are not acceptable.

Ductwork and equipment shall not be hung from roof deck, piping, or other ducts or equipment. Maximum span between any two points shall be 10 feet, with lesser spans as required by duct assemblies, interferences, and permitted loads imposed.

There shall be not less than one set of hangers for each point of support. Hangers shall be installed on both sides of all duct turns, branch fittings, and transitions.

Hangers shall be sufficiently cross braced to eliminate sway vertically and laterally.

Rectangular ducts up to 36 inches shall be supported by strap-type hangers attached at not less than three places to not less than two duct surfaces in different planes.

Perforated strap hangers are not acceptable.

Where trapeze hangers are used, the bottom of the duct shall be supported on angles sized as follows:

<u>WIDTH OF DUCT, INCHES</u>	<u>MINIMUM BOTTOM ANGLE SIZE, INCHES</u>
30 and smaller	1-1/4 by 1-1/4 by 1/8
31 to 48	1-1/2 by 1-1/2 by 1/8

Where ductwork system contains heavy equipment, excluding air-diffusion devices and single-leaf dampers, such equipment shall be hung independently of the ductwork by means of rods or angles of sizes adequate to support the load.

Ducting, when supported from roof purlins, shall not be supported at points greater than one-sixth of the purlin span from the roof truss. Load per hanger shall not exceed 400 pounds when support is from a single purlin or 800 pounds when hanger load is applied halfway between purlins by means of auxiliary support steel provided under this section. When support is not halfway between purlins, the allowable hanger load shall be the product of 400 times the inverse ratio of the longest distance to purlin-to-purlin spacing.

When the hanger load exceeds the above limits, reinforcing of purlin(s) or additional support beam(s) shall be provided. When an additional beam is used, the beam shall bear on the top chord of the roof trusses, and bearing shall be over gusset plates of top chord. Beam shall be stabilized by connection to roof purlin along bottom flange.

Purlins used for supporting fire-protection sprinkler mains, electrical lighting fixtures, electrical power ducts, or cable trays shall be considered fully loaded, and supplemental reinforcing or auxiliary support steel shall be provided for these purlins.

3.3.9 Flexible Connectors for Steel Metal

Air-handling equipment, ducts crossing building expansion joints, and fan inlets and outlets shall be connected to upstream and downstream components by treated woven-cloth connectors.

Connectors shall be installed only after system fans are operative and all vibration isolation mountings have been adjusted. When system fans are operating, connectors shall be free of wrinkles caused by misalignment or fan reaction. Width of surface shall be curvilinear.

3.3.10 Insulation Protection Angles

Galvanized 20-gage sheet, formed into an angle with a 2 inch exposed long leg with a 3/8 inch stiffening break at outer edge, and with a variable concealed leg, depending upon insulation thickness, shall be provided.

Angles shall be installed over all insulation edges terminating by butting against a wall, floor foundation, frame, and similar construction. Angles shall be fastened in place with blind rivets through the protection angle, insulation, and sheet metal duct or plenum. Angles shall be installed after final insulation covering has been applied.

3.3.11 Duct Probe Access

Holes shall be provided with neat patches, threaded plugs, or threaded or twist-on caps for air-balancing pitot tube access. Extended-neck fittings shall be provided where probe access area is insulated.

3.3.12 Openings in Roofs and Walls

Building openings are fixed and equipment shall be provided to suit.

3.4 FIELD QUALITY CONTROL

3.4.1 Fire Damper Tests

Operational tests shall be performed on each fire damper in the presence of the Contracting Officer by energizing fusible link with localized heat. New links shall be provided and installed after successful testing.

3.5 DUCTWORK CLEANING PROVISIONS

Open ducting shall be protected from construction dust and debris in a manner approved by the Contracting Officer. Dirty assembled ducting shall be cleaned by subjecting all main and branch interior surfaces to airstreams moving at velocities two times specified working velocities, at static pressures within maximum ratings. This may be accomplished by: filter-equipped portable blowers which remain the Contractor's property; wheel-mounted, compressed-air operated perimeter lances which direct the compressed air and which are pulled in the direction of normal airflow; and other means approved by the Contracting Officer. Compressed air used for cleaning ducting shall be water- and oil- free. After construction is

complete, and prior to acceptance of the work, construction dust and debris shall be removed from exterior surfaces.

3.6 OPERATION AND MAINTENANCE

Contractor shall submit 6 copies of the Operation and Maintenance Manuals 30 calendar days prior to testing the medium/high pressure ductwork systems. Data shall be updated and resubmitted for final approval no later than 30 calendar days prior to contract completion.

-- End of Section --

SECTION 15819

PRE-ENGINEERED UNDERGROUND HEAT DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASME INTERNATIONAL (ASME)

ASME B31.1	(2001) Power Piping
ASME B40.100	(2000) Pressure Gauges and Gauge Attachments

ASTM INTERNATIONAL (ASTM)

ASTM A 106	(2002a) Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 36/A 36M	(2003a) Carbon Structural Steel
ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Heat Distribution System.

A complete description of the design and assembly of the system, materials of construction and field installation instructions, not later than 21 days prior to the start of field measurements. Submittal shall also include sufficient system details to show that the specified minimum insulation thickness has been met. A detailed design layout of the system (plan and elevation views) showing size, type, elevations and location of each component to be used in the system, the design and location of anchors, pipe guides, pipe supports, expansion loops, Z-bends, L-bends, end seals, leak plates, joint locations, pipe and insulation thickness and sizes, types, and movements, connection to manhole and building wall penetrations, and including, if applicable, details of transition point to aboveground or other type systems. Also,

if applicable, type and details of the cathodic protection system to be used. Detailed design layout drawings shall be stamped by a registered Professional Engineer.

SD-03 Product Data

Expansion Loops and Bends.

Pipe-stress and system-expansion calculations for each expansion compensation elbow using a finite element computer generated 3 dimensional analysis, not later than 7 days after notice to proceed. Calculations shall demonstrate that pipe stresses from temperature changes are within the allowable requirements in ASME B31.1 and that the anchors and the guides will withstand the resultant forces. Detailed design layout drawings shall include all analysis node points. As a minimum, computer analysis results shall include node stresses, forces, moments and displacements. Calculations shall be stamped by a registered Professional Engineer in the employ of the UHDS manufacturer.

Interruption of Existing Service.

Schedule of proposed outages and interruptions of existing services, 14 days in advance.

Work Plan.

A proposed schedule of activities, not later than 21 days after notice to proceed.

Connecting to Existing Work.

Changes required to the UHDS design due to interferences or conflicts, upon realization of interferences or conflicts.

SD-06 Test Reports

Operational Test.

Schedule of testing, 14 days in advance.

Tests

A proposed test procedure and proposed samples of test data sheets for each required test, 30 days prior to the proposed test date. The procedure shall contain a complete description of the proposed test with calibration curves or test results furnished by an independent testing laboratory of each instrument, meter, gauge, and thermometer to be used in the tests. The test shall not commence until the procedure has been approved.

Test reports in booklet form showing all factory and field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system.

Certificate of Compliance.

Upon completion of the work, and before final acceptance, a notarized statement signed by a principal officer of both the UHDS manufacturer and the Contractor, certifying that the system has been installed satisfactorily and in accordance with the contract drawings, specifications, UHDS manufacturer's detailed design layout drawings and with the UHDS manufacturer's recommendations.

Welding

Certification of Acceptability of all welds made in the field, upon completion of the project. This certification shall consist of a letter, signed by an official of the independent testing firm or firms examining welds, stating that all provisions of this specification have been complied with, and that all welds inspected radiographically have met the specified acceptability standards.

SD-10 Operation and Maintenance Data

Heat Distribution System.

Operation and maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, procedures for recording conduit temperatures biannually, and troubleshooting guides, before completion of work. Manual shall include as-built piping layout of the system including final elevations.

1.3 DEFINITIONS

The following definitions shall apply to the work.

1.3.1 Heat Distribution System

A complete pre-engineered, underground heat distribution system including all required components such as carrier pipes, high temperature hot water supply pipe, high temperature hot water return pipe, and fittings, anchors, pipe supports, insulation, protective casing, and corrosion protection, for the system supplied. The pre-engineered system shall include all piping and components to a point at least 6 inches inside the building and at valve. The UHDS shall not use any part of the building station as an anchor point.

1.3.2 Direct-Buried

A system which is buried, without the need for a field-fabricated protective enclosure such as a concrete trench or tunnel.

1.3.3 UHDS Types

1.3.3.1 Direct Buried, Underground Piping System

A factory-fabricated system including an air and water-tight outer protective casing, air space and an insulated carrier pipe. Drains and vents are provided at the end plates of the system (in manholes or buildings). The drains are normally capped but the caps can be removed to drain water which may leak into the air space if there is a failure in the casing or the carrier pipe. The vents allow water vapor to escape and provide a tell-tale sign of leakage.

1.4 WORK DESCRIPTION

1.4.1 Scope

The work shall include the design and fabrication; furnishing; installing, and testing of a direct buried underground insulated high temperature hot water supply pipe, insulated high temperature hot water return pipe consisting of piping as indicated, cathodic protection system (where required by this specification), together with fittings and appurtenances necessary for a complete and operable system. Gland type end seals will not be permitted. DDT systems with fiberglass casings shall not be provided.

1.4.2 UHDS Design

The UHDS manufacturer shall be responsible for the complete design of the UHDS, the product to be supplied, fabrication, witnessing installation and testing of the system within the design parameters established by the contract drawings and specifications, and in compliance with the detailed design. The complete design of the UHDS shall be sealed by a Professional Engineer in the employ of the UHDS manufacturer.

1.4.3 Contract drawings

The contract drawings accompanying this specification provide information on:

- a. The size of carrier pipes, approximate length, and site location of the system.
- b. The routing and elevation of the piping along the route.
- c. The obstacles that must be avoided along the path.
- d. Location of piping anchors (anchors will be no closer than 3 feet or further than 5 feet from entrance to manholes or buildings) at manholes and/or buildings. The UHDS manufacturer shall incorporate anchors as needed for the system.
- e. Operating pressure and temperature of system.
- f. Preliminary layout of thermal expansion loops and anchors. Final layout to be determined by UHDS manufacturer.

1.5 QUALIFICATIONS

1.5.1 Manufacturer

The UHDS manufacturer is the company responsible for the design and manufacture of the pre-engineered system. The manufacturer shall submit certification of past experience as specified in the submittals paragraph; the certificate shall indicate the location, type of system, size of system, point of contact (POC) including phone number, for information verification. This certificate of satisfactory operation shall be an original signed by a principal officer of the UHDS manufacturer. The UHDS manufacturer directs the installation of the system and has a representative on the jobsite. The manufacturer shall submit a list of characteristics indicating what defects or damage will necessitate replacement. The manufacturer shall submit a Quality Assurance Plan for fabrication, delivery, storage, installation and testing of the system. The manufacturer shall submit data sheets for all coatings and indicating thicknesses of insulation for carrier pipes.

1.5.2 Manufacturer's Representative

The UHDS manufacturer's representative shall be a person who regularly performs the duties specified, is certified in writing by the UHDS manufacturer to be technically qualified and experienced in the installation of the system, and shall be authorized by the manufacturer to make and sign the daily reports specified. The UHDS manufacturer's representative shall be under the direct employ and supervision of the UHDS manufacturer.

1.6 SYSTEM REQUIREMENTS

1.6.1 Operating Characteristics

The high temperature hot water supply system shall have an operating temperature of 450 degrees F and an operating pressure of 500 psig. high temperature hot water return system shall have an operating temperature of 450 degrees F and an operating pressure of 500 psig.

1.6.2 Rated Characteristics

Thermal expansion calculations shall be computed for the supply and return piping using the following design characteristics and installation temperature. The system design conditions for high temperature hot water supply and/or return shall be a temperature of 450 degrees F and a pressure of 665 psig. For calculation purposes, the installation temperature shall not be higher than the ambient ground temperature at the site: 40 degrees F.

1.7 STANDARD PRODUCTS

The designed system and equipment provided for this project shall be of current production and shall essentially duplicate systems that have been in satisfactory use for at least 5 years prior to bid opening at 3 locations. The systems shall have been operated under pressure, temperature and site characteristics that are equal to or more severe than the operating conditions in this specification and shall have distributed the same medium.

PART 2 PRODUCTS

2.1 FACTORY FABRICATED, DIRECT-BURIED UHD SYSTEMS

2.1.1 General Description

Pre-engineered direct burial system consisting of carrier pipr, service pipe, insulation, anchors, field joints, guides and insulation as described herein. The exterior jacket of the UHDS shall provide corrosion protection of the carrier pipe and will require no external forms of cathodic protection on the direct buried piping system.

2.1.2 Carrier Pipes and Insulation

Ten gage smooth wall, steel conduit with welded connections. Changes in casing size will be provided as required to accommodate thermal expansion.

The carrier pipe shall be coated with a polyurethane foam having a nominal 2 lb per cubis foot density for all straight lengths and fittings. Insulation thickness shall be 1-inch and a K-value of 0.16 in accoredance with ASTM D 518. The outer jacket shall be a high density polyethelyne jacket and all joints shall be sealed to prevent moisture intrusion. There shall be no metal-to-ground contact.

2.1.3 Service Pipe and Insulation

Schedule 40 steel, seamless 01 electric resistance welded conforming to ASTM A 53, Grade B, Type E or S; or ASTM A 106, Grade B.

The service pipe insulation shall be mineral wood and held in place with stainless steel draw bands. Insulation thickness shall be 1-1/2-inches.

2.1.4 Casing End Plates, Vents, and Drains

End plates shall be made of ASTM A 36/A 36M steel, minimum thickness 1/2 inch for conduit pipe sizes above 12 inches and 0.375 inches for conduit pipe sizes 12 inches and less. A 1 inch ASTM A 53/A 53M, Sch 40, galvanized vent riser pipe shall be provided on end plate vent opening. Vent pipe shall extend to top of manhole and terminate 12 inches above grade with a 180 degree bend. A 1 inch drain shall be provided at the bottom and vent at the top. Brass plugs and half coupling, constructed with welded steel and welded to the end plate, shall be furnished; drains shall be plugged; vents shall not be plugged.

2.1.5 Air Space

Continuous 1 inch minimum air space shall be provided between carrier pipe insulation and casing.

Air space shall be able to be vented and drained. Refer to drawings.

2.1.6 Anchor Plates

Anchor plate shall be ASTM A 36/A 36M steel, welded to carrier pipe and casing, 1/2 inch minimum thickness, with passages for air flow and water drainage thru the annular air space in the system. Exterior surface of the anchor plate shall be coated with the same coating material as the casing.

2.1.7 Field Connections

Field connections shall be made in strict accordance with manufacturer's listed instructions.

2.1.8 Expansion Loops and Bends

Provide necessary fittings, guides and anchors in order to accommodate thermal expansion. Provide oversized fittings, carrier pipe and related as required.

2.2 EXPANSION LOOPS AND BENDS

Stresses shall be less than the maximum allowable stress from the Power Piping Code (ASME B31.1). Detailed design layout drawings and stress and anchor force calculations shall be provided for all loops and bends. Locations of all anchors, guides and supports shall be shown. The calculations shall be based on design characteristics (pressures and temperatures) specified for both the supply and return lines.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

3.1.1 Interruption of Existing Service

The Contractor shall arrange, phase and perform work and provide temporary facilities, materials, equipment, and connections to utilities, to ensure adequate heat distribution service for existing installations at all times.

Only necessary interruptions required for making connections will be permitted, and only at times when approval is obtained from the Contracting Officer. All interruptions shall be between the hours of 8 and 4 as approved by the Contracting Officer.

3.1.2 Grading

Unless otherwise shown on the contract drawings or the detailed design layout drawings, high temperature hot water supply/return lines shall be graded uniformly downward not less than 5.0 inches in 100 feet to the lower point of entry between manholes and/or building entries. Note depth of entry to building shown on drawings. This is necessary to clear perimeter foundation drain.

3.1.3 Connecting to Existing Work

New work shall be connected to existing work in a neat and workmanlike manner. Connections shall be made only in manholes. Where an existing structure must be cut or existing utilities interfere, such obstructions shall be bypassed, removed, replaced or relocated, restored and repaired.

Any changes required to the UHDS design as a result of interferences or conflicts shall be approved by the UHDS designer and the Contracting Officer. Work disturbed or damaged shall be replaced to its prior condition.

3.1.4 Coordination

The location of all items of equipment and work of all trades shall be coordinated. Operability and maintainability of the equipment and systems shall be maintained.

3.1.5 Variations

Any variations from the approved, detailed design layout drawings shall be submitted to the Contracting Officer for approval. Variations shall be signed and sealed by the UHDS manufacturers' professional engineer responsible for the complete design of the UHDS.

3.1.6 Storage and Handling During Installation

Equipment and material placed on the job shall remain in the custody of the Contractor until final acceptance whether or not the Contractor has been reimbursed for the equipment and material by the Government. The Contractor shall be solely responsible for the protection of the equipment and material against damage from any source while stored or during installation. Materials shall be protected against damage from UV light, and entry of water and mud, by installing watertight protection on open ends at all times. Sections of the casing or carrier piping found to have been subjected to full or partial submergence in water (which would allow the insulation to become wet) shall be immediately replaced. Materials awaiting installation shall be covered to protect from UV degradation.

3.2 PIPE, PIPING JOINTS AND FITTINGS

3.2.1 Joint Preparation

Pipe and fittings shall be cleaned inside and outside before and after assembly. Dirt, scale, and other foreign matter shall be removed from inside the piping by use of a pipe swab or pipe pig before connecting pipe sections, valves, equipment or fittings. Eccentric connectors shall be used as needed between casing sections to provide drainage of casing section between manholes and between manholes and buildings.

3.2.2 Direction Changes

Changes in direction shall be made with factory-built reinforced fittings. Field-fabricated fittings and miters will not be permitted.

3.3 WELDING

The Contractor shall be responsible for welding quality and shall:

- a. Conduct tests of the welding procedures used in the work, determine the suitability of the procedures used, determine that

the welds made will meet the required tests, and determine that the welding operators have the ability to make sound welds under standard conditions.

b. Comply with ASME B31.1.

c. Perform all welding operations required for construction and installation of the heat distribution system.

3.3.1 Qualification of Welders

Rules of procedure for qualification of all welders and general requirements for fusion welding shall conform with the applicable portions of ASME B31.1, and as outlined below.

3.3.2 Examining Welders

The Contractor shall examine each welder to determine the ability of the welder to meet the required qualifications. Welders shall be tested for welds in all positions, including welds with the axis horizontal (not rolled) and with the axis vertical. Each welder shall:

a. Weld only in positions in which they have qualified.

b. Identify welds with the specific code marking signifying name and number assigned.

3.3.3 Examination Results

The Contractor shall furnish a list of welder's names and corresponding code markings. Welders which fail to meet the prescribed welding qualifications shall be retested. Welders who fail the second test shall be disqualified for work on this project.

3.3.4 Beveling

Field and shop bevels shall be done by mechanical means or by flame cutting. Where beveling is done by flame cutting, surfaces shall be thoroughly cleaned of scale and oxidation just prior to welding.

3.3.5 Alignment

Split welding rings shall be used for field joints on carrier pipes above 2 inches to assure proper alignment, complete weld penetration, and prevention of weld spatter reaching the interior of the pipe. Field joints 2 inches and smaller shall be made with welding sockets.

3.3.6 Erection

Piping shall not be split, bent, flattened, or otherwise damaged before, during, or after installation. Where the pipe temperature falls to 32 degrees F or lower, the pipe shall be heated to approximately 100 degrees F for a distance of 1 foot on each side of the weld before welding, and the weld shall be finished before the pipe cools to 32 degrees F.

3.3.7 Defective Welds

Defective welds shall be replaced and reinspected in accordance with ASME B31.1. Repairing defective welds by adding weld material over the defect or by peening will not be permitted. Welders responsible for defective welds shall be tested for qualification.

3.3.8 Radiographic Testing

An approved independent testing firm regularly engaged in radiographic testing shall perform radiographic examination of 100% of the field welds in the carrier piping of direct-buried systems in accordance with ASME B31.1.

The following shall be furnished: a set of films showing each weld inspected, a reading report evaluating the quality of each weld, and a location plan showing the physical location where each weld is to be found in the completed project, prior to installing casing field joints, backfilling and hydrostatic testing. All radiographs shall be reviewed and interpreted by a Certified American Society for Nondestructive Testing Level III radiographer, employed by the testing firm, who shall sign the reading report. The Contracting Officer may review all inspection records, and if any welds inspected are found unacceptable they shall be removed, rewelded, and radiographically reexamined at no cost to the Government.

3.4 HEAT DISTRIBUTION SYSTEM INSTALLATION

The UHDS manufacturer's representative shall oversee the delivery, storage, installation and testing of the system. Work shall be in accordance with the requirements specified and with the printed instructions of the manufacturer. These specifications shall take precedence over the printed instructions if conflicts arise. Printed instructions shall be submitted to the Contracting Officer prior to system installation.

3.4.1 Excavation, Trenching, and Backfilling

Excavation, trenching, and backfilling shall be performed as required by the UHDS manufacturer's design and as specified in civil specifications. Pipe shall lay on a 12 inch minimum sand bed and shall be backfilled with sand on all sides to a minimum of 6 inches as measured from outside of casing. Foundation for system shall be firm and stable. Foundation and backfill shall be free from rocks or substances which could damage the system coating. Concrete anchor and thrust blocks shall be installed in undisturbed earth. Backfilling shall not commence until system has been satisfactorily pressure tested (both hydrostatic test of carrier and air test of casing). Minimum depth of burial to the top of the casing shall be 39 inches. Maximum depth of burial to the top of the casing (or PIPI envelope) shall be 10 feet. Provide a minimum 36 inches clearance between any mechanical or electrical utilities. Maximum service temperature of outer conduit pipe shall be submitted with engineering calculations. Provide a minimum of 12 inches clearance from perimeter drain system where lines enter mechanical room.

3.4.2 Protection

Casing coating shall be protected from damage during unloading, storage, rigging and installation. Casing and carrier pipe ends shall be protected from water intrusion during unloading, storage, rigging and installation. Piping and accessories shall be protected from damage due to exposure to UV light.

3.4.3 Defective Material

The UHDS manufacturer's representative shall take prompt action to remove from the site all damaged or defective material, subject to rejection in accordance with the quality assurance provisions included in the manufacturer's submittals and printed instructions, and shall order prompt replacement of such material.

3.5 TESTS

Leak-tightness of all piping systems shall be demonstrated by performing pressure tests (hydrostatic, pneumatic) and operational tests. Heat distribution system shall be pressure tested in conformance with specified requirements and printed instructions for the system supplied; tests shall include carrier piping and casing. The carrier pipe shall be hydrostatically tested. Casings of DDT systems shall be pneumatically tested. Casing and end seals of WSL system shall be tested for intrusion of water into the casing and insulation. Mercury shall not be used in thermometers required for the tests.

3.5.1 Holiday Testing of Direct-buried System Steel Casings

Entire exterior surface of the casing, including the bottom exterior surface, shall be tested for faults in coating after installation in trench, prior to backfilling, using test method and voltage recommended by coating manufacturer. If any holidays are found, they shall be repaired and the coating retested. System shall not be backfilled until all holidays are eliminated.

3.5.2 Pneumatic, Hydrostatic and Operational Tests

Before conducting heat distribution system tests, lines shall be flushed with high pressure water until [discharge shows no foreign matter] [the Contracting Officer, after examining the discharge, stops the flush].

3.5.2.1 Pneumatic Test

The casing of UHD systems shall be pneumatically tested after welding and before field coating using air as the test medium. The test pressure shall be 15 psig. Persons not working on the test operations shall be kept out of the testing area while testing is proceeding. The test shall be made on the system as a whole or on sections that can be isolated. Joints in sections shall be tested prior to backfilling when trenches must be backfilled before the completion of other pipeline sections. The test shall continue for 24 hours from the time of the initial readings to the final readings of pressure and temperature. The initial test readings of the instrument shall not be made for at least 1 hour after the casing has been subjected to the full test pressure, and neither the initial nor final

readings shall be made at times of rapid changes in atmospheric conditions.

There shall be no indication of reduction of pressure during the test after corrections have been made for changes in atmospheric conditions in conformity with the relationship $T(1)P(2) = T(2)P(1)$, in which T and P denote absolute temperature and pressure, respectively, and the numbers denote initial (1) and final (2) readings. Pressure shall be measured with a pressure gauge conforming to ASME B40.100. A throttling type needle valve or a pulsation dampener and shutoff valve may be included. The diameter of the face shall be at least 4.5 inches with a measurable range of 0 to 15 psig and graduations of at least 0.5 psig. During the test, the entire system shall be completely isolated from all compressors and other sources of air pressure. Each joint shall be tested while under test pressure by means of soap and water or an equivalent nonflammable solution prior to backfilling or concealing any work. All labor, materials and equipment for conducting the tests shall be furnished by the Contractor and shall be subject to inspection at all times during the tests. The Contractor shall maintain proper safety precautions for air pressure testing at all times during the tests.

3.5.2.2 Hydrostatic Test

Carrier piping shall be tested hydrostatically before insulation is applied at field joints and shall be proved tight at distribution supply pressure of 600 psig for 2 hours. There shall be no indication of reduction of pressure during the test. Pressure shall be measured with a device calibrated to be read in increments not greater than 0.1 psi.

3.5.2.3 Operational Test

Prior to acceptance of the installation, Contractor shall subject system to operating tests simulating actual operating conditions to demonstrate satisfactory functional and operating efficiency. These operating tests shall cover a period of not less than 6 hours for each portion of system tested. Contractor shall submit for approval a schedule of the tests to be performed. The contractor shall provide calibrated instruments, equipment, facilities and labor, at no additional cost to the Government. When failures occur, problems shall be repaired and test repeated.

3.5.3 Deficiencies

Deficiencies discovered shall be corrected at the Contractor's expense. Major deficiencies, or failure to correct deficiencies, may be considered cause for rejecting the entire installation.

3.6 BURIED UTILITY WARNING AND IDENTIFICATION

3.6.1 Plastic Marking Tape

Polyethylene plastic tape manufactured specifically for warning and identifying buried utility lines shall be supplied and installed. Tape shall be buried above the pipe during the trench backfilling operation and shall be buried approximately 12 inches below grade. Tape shall be 0.004 inch thick polyethylene. Tape shall be acid- and alkali-resistant and shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise

with an elongation factor of 350 percent. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. The tape shall be of a type specifically manufactured for marking and locating metallic underground utilities. Tape shall be 6 inches wide and printed with a caution and identification of the piping system over the entire tape length. Tape shall be yellow with bold black letters. Tape color and lettering shall be unaffected by moisture and other substances contained in the backfill material.

-- End of Section --

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SECTION 15838

POWER VENTILATORS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (2002) Minimum Design Loads for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM A 653/A 653M (2003) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM B 209/B 209M (2004) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 37 (2003) Standard Specification for Aluminum for Use in Iron and Steel Manufacturer

UNDERWRITERS LABORATORIES (UL)

UL 705 (2004) UL Standard for Safety Power Ventilators

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

As-Built Drawings shall be submitted for power roof ventilators in accordance with paragraph entitled, "General Requirements," of this section.

SD-03 Product Data

Equipment and Performance Data shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

Manufacturer's catalog data shall be submitted for the following items:

Housing
Fan
Motor
Bases
Roof Curbs
Dampers
Screens

SD-06 Test Reports

Test reports shall be submitted for system operational tests in accordance with the paragraph entitled, "Tests," of this section.

1.3 GENERAL REQUIREMENTS

Section 15003, "General Mechanical Provisions," applies to work specified in this section.

Section 16225, "Motors" applies to this section.

Equipment and Performance Data shall be submitted for power roof ventilator.

As-Built Drawings shall be submitted for power roof ventilator providing current factual information such as deviations from, and amendments to, the drawings and concealed and visible changes in the work.

1.4 QUALITY ASSURANCE

Ventilators shall be rated and labeled in accordance with the applicable standards of the Air Movement Control Association, and shall be licensed to bear the AMCA seal for both air and sound.

PART 2 PRODUCTS

2.1 ROOF VENTILATORS

Roof ventilators shall comply with UL 705 and be furnished complete with bases, curbs, flashing flanges, noise baffles, dampers, damper controls, louvers, and screens.

Ventilators shall be designed for windloads in accordance with ASCE 7 and in no case shall the installed design be for less than 90 miles per hour windload. Structural bracing shall be properly spaced to accommodate this loading and in accordance with the design requirements of the covering material. Ventilators shall be adequately reinforced and well braced with joints properly formed. Edges shall be wired or beaded where necessary to ensure rigidity. Galvanic action between different metals in direct contact shall be prevented by nonconductive separators. All soldering shall be even and smooth.

Bolts, rivets, and other fastenings used in connection with protected metal shall be corrosion-resistant steel.

2.2 EXPLOSION PROOF FAN

Fan shall be a roof mounted mushroom type listed for use in Class I, Division 1 applications. Fan blades shall be non-ferrous or coated to prevent metal on metal contact. Fan motor shall be outside airstream or explosion proof as per NFPA-70 for Class I, Division 1 installations.

Power roof ventilator shall be round mushroom style as indicated.

2.3 FAN TYPE(S)

Fan shall be of the following type(s):

2.3.1 Type C-PRV Centrifugal, Direct Drive

Type C-PRV ventilator shall be a centrifugal roof ventilator with direct drive, nonoverloading, backward-inclined wheel. Drive shall be vibration isolated with elastomer. Drive components shall be mounted in a compartment isolated from airstream.

2.3.2 Type CB-PRV Centrifugal, V-Belt Drive

Type CB-PRV ventilator shall be a centrifugal roof ventilator with V-belt drive, nonoverloading, backward-inclined wheel. Drive shall be vibration isolated with elastomer. Drive components shall be mounted in a compartment isolated from airstream.

2.3.3 Inline Cabinet Fans

Fans shall be inline, direct driven cabinet type centrifugal exhaust fan. Fan shall be UL 705 listed and bear the AMCA certified ratings seal for sound and air performance. The inlet box shall be a minimum of 22 gauge galvanized steel. Motor shall be isolation mounted to housing. Wheel shall be forward curved, centrifugal and balanced in accordance to AMCA Standard 204-96. Motor shall be open drip proof with permanently lubricated bearings and include thermal overload protection and disconnect plug. Provide integral aluminum or plastic grille as scheduled.

2.3.4 Mixed Flow Fan (RF-1)

Fan shall be belt driven, tubular mixed flow blower. Fan shall be UL 705 listed and bear the AMCA certified ratings seal for sound and air performance. The fan shall be of welded and bolted construction. Housing shall be a minimum of 16 gauge galvanized steel. Provide straightening vanes as required for sound and energy performance. Provide extended lube lines. Wheel shall be non-overloading, high efficiency, mixed flow type. Blades shall be continuously welded to the back plate and inlet shroud. Hubs shall be keyed and secured to the fan shaft. Wheel shall be balanced according to AMCA Standard 204-96. Motor shall be inverter duty with permanently lubricated, sealed ball bearings.

2.3.5 Materials Handling Fan (EF-6)

Fan shall be a single width, single inlet, radial blade specifically designed for materials handling. Fan shall be UL 705 listed and AMCA

certified rating for air performance. The scroll wrapper and scroll side panels shall be constructed of 10 gauge steel. The fan housing shall have continuously welded seams for exterior installations. Housing side panels shall be rigidly reinforced with structural steel to prevent flexing and vibrations at high pressures. Fan housing shall be coated with manufacturer's standard coating suitable for exterior mounting. Fan shall be primed for field painting to match Base standard color schemes. Fan wheel shall be a minimum of 7 gauge steel, continuously welded to hub and gusset. Wheel shall be balanced in accordance with AMCA Standard 204-96. Fan motor shall be heavy duty type with permanently lubricated ball bearings. Shaft shall be AISI-C1045 hot rolled, sized for critical speed of 125 percent of maximum RPM. Bearings shall be ball or roller type in a cast iron pillow block housing and selected for a minimum L50 life of 200,000 hours.

2.3.6 Power Exhaust Fan (PEF-1)

Induce draft chimney fan for exhausting combustion products. Fan shall be constructed of corrosion resistant cast aluminum and be finished in manufacturer's standard finish suitable for exterior mounting. The fan housing shall be hinged for service access and have stainless steel mesh bird screen. Fan motor shall be totally enclosed with Class H insulation rating. Fan blades shall be backward inclined. Fan shall be suitable for operating temperatures of up to 575 degrees F. Provide accessories listed on drawings.

2.4 MATERIALS

Materials shall be manufacturers' standard materials.

2.4.1 Aluminum Alloy

Aluminum alloy shall be in accordance with ASTM B 209/B 209M and ASTM B 37.

2.4.2 Zinc-Coated Steel

Zinc-coated steel shall be in accordance with ASTM A 653/A 653M.

2.5 FAN MOTOR

Belt drive motors smaller than 1/2 horsepower shall be single-phase, 120 volts, 60 hertz with permanently lubricated ball bearings and shall be split-phase type.

Motors 3/4 horsepower and larger shall be three-phase, 208 volts, 60 hertz.

Motors shall have local disconnects to provide means for fan and motor maintenance. All motors shall be provided with thermal overload protection. Motors located in airstreams shall be totally enclosed type.

Direct drive motors 3/4 horsepower and smaller shall be of the energy efficient permanent split capacitor type, single phase, 60 hertz.

Exhaust fan EF-4 shall be explosion proof.

2.6 BASES

Bases provided with the ventilators shall be factory formed, of the type indicated, shall be the same material as the hoods, and the thickness necessary to meet the design requirement for connection to the roof. Bases shall be suitable for raised curb mounting where indicated. Curb flanges of the base shall be formed as cap flashing extending at least 2 inches over roofing base. Where indicated or required, shafts of ventilators shall be extended a sufficient distance through the supporting construction to permit attachment of vent ducts.

2.7 ROOF CURBS

Factory-formed metal ventilator curbs shall be of type and design required for the ventilator and suitable for roof configuration and flashing.

Job-built curbs shall conform to the recommendations of the ventilator manufacturer, shall be sized correctly for the ventilator, and shall be suitable for type of supporting roof construction.

2.8 BACK-DRAFT DAMPERS

Back-draft dampers shall be gravity operated with adjustable counterweight of the same material as fan housing.

2.9 SCREENS

Bird screens shall be provided with frames of the same material as that used in the ventilators and shall be securely attached in a manner that will permit easy removal for access and cleaning.

PART 3 EXECUTION

3.1 INSTALLATION

Power roof ventilators shall be installed in accordance with manufacturer's installation instructions. Installation of ventilators shall be properly coordinated with other work. Anchors, attachments, and other items to be built shall be coordinated for installation as the work progresses. Ventilators shall be rigidly installed in a weathertight and watertight manner and shall be free from vibration. Refer to Section 15072, "Vibration Isolation for Air Conditioning Equipment," for vibration isolation considerations.

Installation Drawings shall be submitted for power roof ventilator in accordance with referenced standards in this section.

3.2 TESTS

After installation, each power roof ventilator shall be tested to demonstrate proper operation at indicated and specified performance requirements including running, balance, noise, and proper direction of fan rotation.

3.3 LUBRICATION

Movable parts of dampers and related operating hardware shall be lubricated in accordance with manufacturer's printed instructions and shall operate smoothly and quietly without binding.

3.4 FINAL TEST REPORTS

Final test reports shall be provided to the Contracting Officer. Reports shall have a cover letter/sheet clearly marked with the System name, Date, and the words "Final Test Reports - Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database."

-- End of Section --

SECTION 15840

AIR TERMINAL UNITS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 880 (1998) Air Terminals

AIR DIFFUSION COUNCIL (ADC)

ADC-01 (2001) Directory of ADC Certified Products

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A (2002) Standard for the Installation of Air Conditioning and Ventilating Systems

NFPA 90B (2002) Standard for the Installation of Warm Air Heating and Air Conditioning Systems

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Materials, Equipment, and Fixture Lists and Records of Existing Conditions shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

SD-02 Shop Drawings

As-Built Drawings shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

SD-03 Product Data

Equipment and performance data shall be submitted for the following items consisting of use life, system functional flows, safety features, and mechanical automated details. Curves indicating tested and certified equipment responses and performance characteristics shall also be submitted.

Variable Constant-Volume Boxes

Manufacturer's catalog data shall be submitted for the following items:

Variable Constant-Volume Boxes

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be submitted in accordance with paragraph entitled, "Operation and Maintenance," of this section.

1.3 GENERAL REQUIREMENTS

Section 15003 GENERAL MECHANICAL PROVISIONS applies to work specified in this section.

Materials, Equipment, and Fixture Lists shall be submitted for all materials, equipment, and fixtures to be incorporated in the work. Lists shall include manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site information.

As-Built Drawings shall be submitted providing current factual information, including deviations and amendments to the drawings, and concealed and visible changes in the work.

Units shall be provided with the configuration, capacity, and static-pressure characteristics indicated.

Where dimensional data are given, these shall constitute nominal sizing, which shall be adjusted by the manufacturer when necessary to accommodate acoustic material thickness.

Units identical to the proposed units shall have at least 2 years of proven satisfactory field service.

Units shall be certified as having been ADC-01 tested and rated.

PART 2 PRODUCTS

2.1 VARIABLE CONSTANT-VOLUME BOXES

Provide boxes of double wall construction with one inch thick insulation, which meets NFPA 90B, between the inner and outer walls. Outer casing shall be minimum 22-gage galvanized steel. Inner layers shall be minimum 26 gage galvanized or phosphatized steel. The casings shall be provided with a double walled, insulated access door to allow inspection, maintenance and removal of the control valve/damper, actuator system, and heating coil.

Casing shall be fabricated from galvanized steel and shall have internal thermal and acoustic insulation. Insulation shall be coated to prevent

erosion and shall conform to NFPA 90A.

Variable air volume boxes shall be selected to provide sound levels equal to or lower than listed NC values. Sound data shall be maximum for radiated and discharge NC levels as tested in accordance with ARI 880 at 1-inch inlet static pressure.

Casing internal leakage shall be limited to 2 percent of nominal box capacity when the internal pressure is 1 inch wg.

Casing shall be constructed of 0.040-inch aluminum or 22-gage mill-galvanized steel and shall contain removable panels for access to interior parts. Units shall be insulated internally with 1/2-inch thick mineral-faced thermal and acoustic insulation, conforming to NFPA 90A.

Casing shall be fitted with rigid, airtight access panels, easily removable, and of ample size to give free access to all interior parts.

Label each box with building location and factory-set air volume or field-set calibration curve.

Certify air terminal units and variable constant-volume boxes to meet ARI 880.

2.1.1 Medium and High Velocity Boxes

Box shall be supplied with variable constant-volume regulator consisting of aluminum and coated-steel frame with aluminum vanes, corrosion-resistant steel adjusting spring, and neoprene pulsation snubber.

Variable constant-volume regulator shall be factory set for an air capacity within plus 5 percent of the indicated maximum and minimum air quantities, regardless of variations in inlet static pressure from minimum to 6 inches wg.

Minimum air capacity shall be a percentage of the maximum air capacity indicated and shall be easily changed in the field.

A calibration chart indicating 100 percent air capacity versus adjusting screw shall be furnished with each box.

PART 3 EXECUTION

3.1 INSTALLATION

Equipment shall be installed as shown on the drawings and in accordance with the manufacturer's recommendations.

Listing of Product Installations for the following items shall include identification of at least 5 units, similar to those proposed for use, that have been in successful service for a minimum period of 5 years. List shall include purchaser, address of installation, service organization, and date of installation.

3.2 TESTS

Coils shall be tested under water at 150 percent of the working pressure or 300 psig for 200 pounds per square inch working pressure.

Reports for High-Pressure Ductwork, Duct Mixing Boxes, Low Pressure Ductwork and Variable and Constant Volume Boxes shall include sound ratings submitted in terms of discharge sound-power levels in each of the second through sixth octave bands for specified or indicated inlet pressure ranges. A nominal space Noise Criteria (NC) index shall be shown for at least three operating points, including ratings at design, maximum, and minimum volume operation.

Reports for Terminal Reheat Units shall include sound-power levels, decibel reference 10 to the minus 12 power watts for each of the second through seventh octave bands, and for inlet pressures of 1 through 6 inches water gage (wg) for all operating conditions. A nominal space NC sound-pressure level index shall be shown for each of at least three volume ratings, including minimum and maximum. Index shall be the highest point of NC rating after deducting 18-decibel; (dB) room attenuation from the sound-power level in each octave band.

3.3 OPERATION AND MAINTENANCE

Contractor shall submit 6 copies of the Operation and Maintenance Manuals 30 calendar days prior to testing the following items. Data shall be updated and resubmitted for final approval no later than 30 calendar days prior to contract completion.

-- End of Section --

SECTION 15852

DIFFUSERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 113	(1990) Method of Testing for Room Air Diffusion
ASHRAE-03	(1997) Handbook, Fundamentals (IP Edition)
ASHRAE-06	(1997) Handbook, HVAC Systems and Equipment (IP Edition)

1.2 GENERAL REQUIREMENTS

Section 15003 GENERAL MECHANICAL PROVISIONS applies to work specified in this section.

Material, Equipment, and Fixture Lists shall include the manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site information.

Manufacturer's Standard Color Chart shall indicate the manufacturer's standard color selections and finishes for air-diffusion devices.

1.3 PERFORMANCE REQUIREMENTS

Air diffusion devices shall be certified as having been tested and rated in accordance with ASHRAE-06, Chapter 17; ASHRAE-03, Chapter 31, and ASHRAE 113, where such certification is required.

Equipment and Performance Data shall be submitted for air-diffusion devices consisting of sound data in terms of Noise Criteria (NC) index for the capacity range of the device.

1.4 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

The following shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

Material, Equipment, and Fixture Lists

SD-03 Product Data

Equipment and Performance Data shall be submitted for air-diffusion devices in accordance with paragraph entitled, "Performance Requirements," of this section.

PART 2 PRODUCTS

2.1 AIR-DIFFUSION DEVICE CONSTRUCTION

Air-diffusion device construction and mounting shall preclude flutter, rattle, or vibration. Devices shall have the modifications and accessories necessary for mounting in indicated surface construction.

Color selection shall be as indicated.

Supply diffusers shall be provided with combination damper and equalizing grid where indicated on drawings. Dampers shall be extracting-splitter type, except as otherwise indicated.

2.2 TYPES OF AIR-DIFFUSION DEVICES

2.2.1 Type DLS

Type DLS supply diffuser shall be linear slot type, extruded aluminum construction, with fully adjustable integral air pattern and volume control vanes that deflect air pattern from horizontal along ceiling to straight down, or any intermediate setting. Pattern control element shall permit complete blanking-off of slot.

Slot width shall be as noted on drawings.

Number of slots per unit run shall be as indicated.

Butts in continuous runs shall be aligned for hairline joints.

Ends of diffuser shall butt against walls without mitered end caps. End caps shall be provided where slot terminates.

Exposed-to-view part of frame shall be anodized aluminum, and all interior exposed-to-view components shall have a black matte finish.

2.2.2 Type DSA

Type DSA supply diffuser shall be square with three expanding flared members to provide radially diffused discharge air. Flared members shall be arranged to provide air throw pattern as indicated on drawings. Pattern adjustments shall include horizontal, vertical projection, and an intermediate position or range.

Finish shall be baked enamel.

Construction shall be aluminum as indicated on drawings.

Integral extended surface to fit into module of lay-in ceiling shall be provided where indicated on drawings.

2.2.3 Type GS

Type GS supply grille shall be double deflection type with adjustable face bars parallel to short dimension and adjustable rear bars parallel to long dimension.

Finish shall be baked enamel.

Construction shall be as indicated on drawings.

Integral extended surface to fit into module of lay-in ceiling shall be provided.

2.2.4 Type GR

Type GR return grilles shall be single deflection type with fixed face bars.

Grilles installed in vertical surfaces shall have horizontal face bars set downward at 35 degrees from vertical.

Grilles installed in horizontal surfaces shall have face bars straight and parallel to short dimension.

Finish shall be baked enamel.

Construction shall be as indicated on drawings.

Integral extended surface to fit into module of lay-in ceiling shall be provided.

2.2.5 Type RS

Type RS shall be supply register, double-deflection type, with adjustable face bars parallel to short dimension and adjustable rear bars parallel to long dimension. Dampers shall be opposed-blade type.

Finish shall be baked enamel.

Construction shall be as indicated on drawings.

2.2.6 Type RR

Type RR shall be return register, single-deflection type, and shall have fixed face bars with opposed-blade dampers.

Registers installed in vertical surfaces shall have horizontal face bars

set downward at approximately 35 degrees from vertical.

Registers installed in horizontal surfaces shall have face bars set straight and parallel to short dimension.

Finish shall be baked enamel.

Construction shall be as indicated on drawings.

2.2.7 Type DL

Type DL shall be supply, drum louver with ganged or independent adjustable vertical blades and articulating pivot point for throw adjustment. The DL shall be of aluminum construction.

PART 3 EXECUTION

3.1 INSTALLATION

Equipment shall be installed as indicated and specified and in accordance with manufacturer's recommendations.

Wall-mounted return registers shall be mounted 6 inches above the finished floor.

Installation Drawings shall be submitted for air-diffusion devices. Drawings shall indicate overall physical features, dimensions, ratings, service requirements, and equipment weights.

-- End of Section --

SECTION 15905

BASEWIDE ENERGY MANAGEMENT AND CONTROL SYSTEM (EMCS) -- HSQ SYSTEM

PART 1 GENERAL

1.1 WORK INCLUDED

The work consists of the installation of all field devices, sensors, relays, controllers, enclosures, panels and wiring for connection to and interface with the existing Base Energy Management and Control System (EMCS). Included is all required data point setup, preparation, programming, testing and training to provide a complete and functional EMCS system. The work for this repair and upgrade addition to the EMCS shall be accomplished using only HSQ products for a complete and proper interface into the existing HSQ EMCS system. The HSQ products include but may not be limited to the RTU panel, and associated RTU components and all system software.

The project generally involves the installation of new EMCS in designated buildings as well as the expansion of existing EMCS in buildings that are already connected to the Base system.

The existing host Central Control Unit (CCU) is manufactured by HSQ Technology. The direct digital control system shall interface directly to the HSQ host and HSQ global controllers without need for third party interface devices.

1.2 SYSTEM DESCRIPTION

General: The Energy Monitoring and Control Systems (EMCS) shall be an extension of the existing basewide system. All computing devices, as defined in FCC Rules and Regulations, Part 15, shall be verified to comply with the requirements for Class A computing devices and labeled as set forth in FCC Rules and Regulations, Part 15. The existing host Central Control Unit (CCU) shall perform data consolidation, control algorithms, predictions, and calculations. The system shall provide operator interaction and dynamic process manipulation, including overall system supervision, coordination, and control. Sensed data shall be obtained from the Remote Terminal Devices - RTU, which are located within their particular data environments (DE). The RTU shall be as manufactured by HSQ Technologies, Model 25486 (most current version) and the system expansions shall be based on this equipment. The RTU shall manage all control functions within their DE. Every connected analog output (AO), analog input (AI), digital output (DO), and digital input (DI) represents a "point" where referred to in this specification

Field Enclosures: Ferrous metal enclosures shall conform to the requirement of NEMA Pub. No. 250 for the enclosure types specified. Finish color shall be the manufacturer's standard, unless otherwise indicated. Damage surfaces shall be repaired and refinished with original type finish.

Indoor enclosures shall be NEMA 12 when installed in other than a clean

dry environment, or as shown. Equipment installed outdoors shall be housed in a NEMA 4 enclosure, unless otherwise shown. Penetrations shall be sealed to preclude entry of water using a silicone material conforming to Fed. Spec. ZZ R 765 for all enclosures.

Data Base Update: Under system normal heavy load, the CCU point database shall be updated such that any change in analog value or digital status is no older than 15 seconds.

Nameplates: Provide laminated plastic nameplates for all equipment and monitoring and control devices furnished. Each nameplate shall identify the function, such as "mixed air controllers" or "cold deck temperature sensor". Laminated plastic shall be one-eighth inch thick, black with white center core. Nameplates shall be a minimum of 1 inch by 3 inch, with minimum one-quarter inch high engraved black lettering. Nameplates for devices smaller than 1 inch by 3 inch shall be attached by a non-ferrous metal chain.

Abbreviations, Symbols, and Definitions: All letter symbols and engineering unit abbreviations utilized in information displays and printouts shall conform to the ASHRAE Handbook, Fundamentals.

Environmental Conditions:

The RTU cards, and all other field equipment shall operate under ambient environmental conditions of 35 to 122 deg F dry bulb and 10 to 95 percent relative humidity, non-condensing. Sensors and control elements shall operate under the ambient environmental temperature, pressure, humidity, and vibration conditions specified or normally encountered for the installed location.

Other equipment shall, unless designed otherwise, operate properly under ambient environmental conditions of 60 to 85 deg F and a relative humidity of 20 to 80 percent.

Power Line Surge Protection: Protect all equipment power supplies from line surges. Equipment shall meet the spike susceptibility requirements of MIL-STD-461 Part 7, CS06. Provide protection near equipment in a separate metallic enclosure at ground potential and as necessary at the power panel to insure protection against surges. Fuses shall not be used for surge protection.

Sensor and Control Wiring Surge Protection: Protect all equipment against surges induced on control or sensor wiring installed outdoors. Meet the IEEE 472 surge withstand capability test. Provide protection near equipment in a separate metallic enclosure at ground potential. Fuses shall not be used for surge protection.

Communications Links Surge Protection: Protect all communications equipment against surges induced on any communications link. All cables and conductors which serve as communications links between CCU, and RTUs shall have surge protection circuits installed at each end that meet the IEEE 472 surge withstand capability test. Provide protection near equipment in a separate metallic enclosure at ground potential. Fuses

shall not be used for surge protection.

Communications Links Overvoltage Protection: Protect all communications equipment such as MODEMs, line drivers, and repeaters against overvoltage on any communications links conductors. All cables and conductors, which serve as communications links shall have overvoltage protection for voltages up to 480 Vac rms 60 Hz installed.

Control Diagram: Provide framed drawings under laminated plastic showing complete instrumentation and control diagrams for all equipment furnished, and interfaces to all existing equipment at each respective equipment location. Condensed operating instructions explaining preventive operation, and procedures for safely starting and stopping the system manually shall be prepared in typed form, framed as specified for the wiring and control diagrams and posted beside the diagrams. Proposed diagrams, instructions, and other sheets shall be submitted prior to posting. The framed instructions shall be posted before acceptance testing of the systems. Provide a reproducible copy of each revised diagram in addition to the framed copy.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

Shop Drawings

Shop drawings shall be submitted in accordance with Section 01000 and shall consist of a complete list of equipment and materials, including manufacturer's catalog cuts, and installation instructions. Shop software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Drawings shall show proposed layout and installation of all equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation

Operation and Maintenance Manuals

Operation and Maintenance Manuals: Provide two copies of the manuals bound in hardback, loose-leaf binders, to the Government after acceptance. Provide a draft copy with the performance verification test procedures for use during site tests and update with any changes required prior to final acceptance. Identify each manual's contents on the cover. The manuals shall include the names, addresses, and telephone numbers of each subcontractor installing equipment and systems, and of the nearest service representatives for each item of equipment and each system. The manuals shall have a table of contents and tab sheets. Place the tab sheets at the beginning of each chapter or section and at the beginning of each appendix. Update all manuals to include modifications made during installation, checkout, and acceptance. Manuals provided shall include:

Functional Design Manual: The functional design manual shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. Hardware and software functions, interface, and requirements shall be provided for all system operating modes.

Hardware Manual: Furnish a hardware manual describing all equipment provided, including:

- General description and specifications.
- Installation and checkout procedures.
- Electrical schematics and layout drawings.
- Alignment and calibration procedures.
- Manufacturer's repair parts list indicating sources of supply.
 - Include Federal Stock number where normally provided.
- Signal identification and timing diagrams.

Maintenance Manual: The maintenance manual shall provide descriptions of maintenance for all equipment including inspection, periodic preventative maintenance, fault diagnosis, and repair or replacement of defective components.

Instrumentation and Control (ITC) Diagrams: Drawings shall be provided for all control equipment. Diagrams shall include interface points to HSQ system and arrangement/location on mechanical system

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Where two units of the same type of equipment are required, these units shall be products of a single manufacturer. Each major component of equipment shall have the manufacturer's name and address, and the model and serial number in a conspicuous place

2.2 GLOBAL CONTROLLER -- RTU

Remote Terminal Unit (RTU). The RTU shall be as manufactured by HSQ, model 25486 or the current updated version of that model. RTU is a microprocessor based control and data acquisition system and to be a fully compatible with the central host computer and other RTU's. Basic unit with 32 digital inputs and 2 high-speed counter inputs. Expansion modules to allow for additional analog and digital points. Unit to be U.L. listed and meeting requirements of FCC part 68 emission standards. Unit provided with circuit protector. RTU to be equipped with radio telemetry system compatible with existing Base system.

RTU's shall be microcomputer based with a minimum word size of eight bits. All chips or functional modules shall be second sourced. Provide in each RTU a minimum of 10 percent of its I-O functions as spare capacity. The type of spares shall to in the base proportion as the implemented I-O functions on the RTU, but in no case shall there be less than two spare

points of each I-O type. The RTU with local I-O functions shall be furnished complete, with no changes or additions necessary to support implementation of spare functions. Output relays associated with digital signals shall be considered part of the I-O function, whether physically mounted on the enclosure or separately mounted. Implementation of spare points shall necessitate only provision of the additional field sensor or control, necessary wiring, and connection to the system, and point definition assignment by the operator. Construct the RTU so that all functions are implemented on replaceable circuit boards to permit field maintenance.

The RTU shall include the following controls:

Main Power Switch

On-off line - enable and disables communications with CCU.

Self test - exercise RTU and communications link functions.

Reset - initializes CPU operation.

RTU outputs disable - forces DE to failure mode.

The RTU shall include the following indicators:

Power on - includes one for each power supply voltage.

On Line (CCU controlled).

GO/NO GO for self test of RTU and all communications functions.

RTU outputs disabled.

Provide a real time clock maintaining seconds, minutes, hours, and day of the week, accurate to plus or minus 10 seconds per day.

Provide a minimum of 8K bytes of addressable RAM in addition to that required for RTU operation. Where PROMS are utilized for applications programs in the RTU, provide 4K bytes of RAM and 4K bytes of PROM in lieu of 8K bytes of RAM.

Provide one communications interface and associated drivers conforming to EIA RS-232-C for communications between the RTU and the CCU. Provide communication interfaces between RTUs and MUXs, conforming to EIA RS-422-A, RS-423-A or RS-232-C where no conflict exists with Government furnished DTM.

Provide a sealed battery backup for the real time clock and the RAM chip on the RTU for a period of 1 hour. Provide circuitry to eliminate erratic operation due to low battery charge, sensing battery performance to execute an orderly shutdown before the electronic minimum operating point is reached. Provide automatic charging of batteries and an alarm indication at the CCU that the RTU is operating under battery power.

Power fail automatic restart: Upon restoration of power, the RTU shall automatically begin program execution as specified.

Provide a 120 VAC, 15 A, 60 Hz duplex outlet either in the RTU enclosure or within 6 feet.

Provide locking type mounting cabinets with common padlock keying (per existing Base standard keying) and door switch wired to a RTU input for intrusion alarm in the MCR.

2.3 SYSTEM INTERFACE AND NETWORK CONTROLLERS (SINC'S)

Description: The SINC is a configurable System Controller with an extended communication capability, but on inputs and outputs. It shall be capable of performing the management functions of a System Controller. The SINC's primary duty will be communication between the HSQ Global Controller and the System Controllers (SC) and Terminal Controllers (TC) used for specific mechanical systems control.

The SINC shall have two RS-232 port to allow simultaneous communication with a directly connected personal computer (PC) and a PC or Ethernet connection.

The SINC shall have a System Bus RS-485 operating at up to 19,200 baud to communicate with TC's and SC's.

The SINC shall be able to pass messages from either RS-232 port through to the System Bus or either of the 2 Local Buses.

2.4 SYSTEM CONTROLLERS (SC'S)

System Controllers shall be fully configurable, non-application specific controllers capable of supervising Terminal Controllers and providing management duties. The SC's shall comprise a single device capable of fully performing its specific instructions without the need for add-on cards or modules. The SC's shall be based on a multi-layer printed circuit boards in metal enclosures with 16-bit microprocessors, battery backed calendar clock and two communications port, on-board RS-232 and RS-485, a minimum scan time of 1 second and minimum communications speed of 9,600 baud.

Firmware: Object orientated firmware shall be embedded in each SC so that linking pre-defined objects can configure specific sequences. No special programming language shall be necessary to fully configure SC's. Objects shall include inputs, outputs, schedule, control state, after hours, optimum start, demand managers, clock, poll list, alarm, poll manager, PID loops, logic, timers, calculated points, trending, display manager/list, counters, static trend, event manger, event log, function, sequence, calendar, notify and notify log. The ability to allocate multiple instances of control objects shall be provided. Each controller shall contain all available objects that may be used as required limited only by the maximum memory of the controller. All configurations shall be retained indefinitely through power outages in non-volatile memory.

Controllers: SC's shall perform DDC and energy management functions, control peripheral devices, and coordinate communications to other SC and TC's in the network.

Communication Ports: SC's shall provide concurrent communication to both the system bus and local bus. In addition, a minimum of one RS-232 or RS-485 port shall be provided for connection to user interface PC.

SC Firmware: The SC's shall contain pre-programmed firmware modules for the creation of standard applications. Modules will include as a minimum PID, schedules, calendar functions, logic, timers and optimum start. Each controller shall be capable of performing basic mathematical calculations. The controllers shall be capable of performing complex logical statements.

SC Trending: Each controller shall be capable of trending any system variable over user-defined intervals ranging from one second to four hours. Any system variable can be trended. A maximum of 256 bytes or 128 word values can be stored in each trend. Trends may be manual or rotating. Trends maybe uploaded to the user interface computer for display or storage.

SC Alarming: For each system point, alarms can be created based on high/low limits, change of value or state or fault conditions. An adjustable time delay shall be included to prevent nuisance alarms. All alarms will be tested each scan and can result in the generation of one or more alarm messages. Messages and reports can be sent via the network to the Global Controller.

Real Time Clock: A battery backed uninterruptible clock shall provide the following information: time of day, day, month, year and day of week. The clock shall automatically correct for daylight savings and leap years.

Power Supply: SC's shall operate from 24 VAC 60 Hz power with a tolerance of $\pm 10\%$. The controller shall contain over voltage surge protection.

Automatic Restart after Power Failure: Upon restoration of power, the SC shall automatically update all monitored functions, resume operation based on current values and implement special startup strategies as required.

Inputs: The input section of the System Controller shall provide universal inputs capable of accepting information on any point in the form of temperature, voltage, current, digital or pulse counter, with only a programming change required for differentiation

Analog Inputs: The Analog Input (AI) function shall monitor each analog input, perform A/D conversion and hold the digital value in a buffer for interrogation. The A/D conversion shall have a minimum resolution of 10 bits. Input ranges shall be with the ranger of 0 to 5 VDC or 4 to 20 mA.

Digital Inputs: The Digital Input (DI) function shall accept normally open or closed dry contact closures.

Pulse Accumulator Inputs: The pulse accumulator input function shall

have the same characteristics as the DI, except that in addition a buffer shall be included to totalize pulses between interrogations. Each input shall accept pulses up to 10 Hz.

Temperature Inputs: Temperature inputs originating from a 2 kohm or 10 kohm type 2 thermistor shall be monitored and buffered as an AI and provide automatic conversion to degrees F or C.

Input Wiring: All inputs shall be two-wire devices.

Outputs: Output functions shall include digital, tri-state, pulse width modulation and analog.

Digital Output: The Digital Output (DO) function shall provide contact closure operation of field devices using maintained, verified, duty-cycled, or pulse on-off pairs. Contact rating shall be a minimum of 2 amps at 24 VAC

Tri-State Outputs: Tri-state outputs shall consist of two 24 VAC relays for control of bi-directional (floating point) actuators to a resolution of 1 second. Each tri-state output pair is capable of time base or feed back control.

Pulse Width Modulation Outputs: Output pulse width for base time shall be selectable between 1 and 255 seconds with a minimum output resolution of 0.1 seconds.

Analog Outputs: Analog outputs shall be suitable for up to 5 mA over 0 to 10 VDC referenced to ground.

2.5 TERMINAL CONTROLLERS (TC'S)

Description: A TC has its own on board CPU, RAM and EPROM, laptop communication port and network connection (via SINC). The TC contains its own on board I/O for a complete stand-alone control. SC is an application specific controller suitable for type of mechanical system controlled. TC's shall be based upon multi-layer printed circuit boards with 8-bit microprocessors, a RS-485 port (to SINC) and a minimum communications speed of 9,600 baud. All TC's shall be pre-programmed with multiple, application specific terminal control routines. No batteries shall be required for TC's.

Configuration: The TC may be programmed from a laptop service tool.

Application Firmware: The custom application firmware shall reside in non-volatile EPROM or flash memory.

The TC's shall provide stand-alone control of HVAC systems as describe in Contract Drawings and Sequence of Operation. Each controller shall have its own control programs and will continue to operate in the event of loss of communication to the rest of the network. Each TC shall be capable of performing its necessary sequence of operation without communications to other controllers. Each TC shall be cable of being field re-programmed.

Communication Ports: Terminal Controllers shall provide communication to the local bus. In addition a RJ-45 port shall be provided for connection to a laptop service tool, via the wall sensor or directly.

TC Trends: Each TC shall be capable of trending two variables at time intervals ranging from 15 minutes to 4-hours. A maximum of 96-byte value shall be stored in each trend. Trends may be uploaded to the user interface device for display or storage.

TC Alarms: Each TC shall have predefined high and low limit alarms.

Power Supply: Each TC shall have a built in power supply operating at 24 VAC, 60 Hz, $\pm 10\%$.

Enclosure: TC's may be housed in an optional steel enclosure or in a plastic enclosure with a rating UL-94-5V or UL-94-V-0 suitable for installation in return air plenums

Inputs/Outputs: The input section of the TC shall provide eight inputs capable of accepting information on any point in the form of temperature, voltage, or contact closer. Output types shall include digital and tri-state.

Temperature Inputs: Temperature signals originating from a thermistor shall be monitored and buffered as an AI and provide a conversion to degrees F or C.

Relay Outputs: The TC shall provide eight relay outputs with a minimum contact rating of 2 amps at 24 VAC, normally open or closed contacts with an isolated common return.

Digital Outputs: The DO function shall provide pilot duty, maintained contact closure for operation of field devices. Contact rating shall be a minimum of 1 amp at 24 VAC.

Tri-State Outputs: Tri-state outputs shall consist of two 24 VAC triacs for control of bi-directional actuators.

Networking: Each TC shall communicate to SC (if used) and SINC via local bus.

2.6 SENSORS

Room Temperature Sensors: The room sensor shall be a precision thermistor accurate within 0.5 degrees over the range of the application. Temperature range shall be from 55 to 95 deg F. The sensor shall be supplied with an RJ-45 modular connector for connecting prefabricated sensor cables, the other end of the sensor cables to plug into the associated TC. Room sensor shall have user adjustable slide bar and a thermometer type temperature display with room override. Slide bar adjustment shall include a pre-programmed dead band of ± 3 deg F from setpoint. Dead band shall be programmed either in the sensor or on the associated TC.

Duct Sensors: The duct sensor shall be a precision thermistor accurate to

within 0.5 deg F over the 45 to 160 deg F range. The sensing element shall be packaged in a stainless steel tubes up to 16-inches long, connected to a standard 4-inch by 4-inch electrical junction box.

Outside Air Sensor: The outside air sensor shall be a precision thermistor accurate to within 0.5 deg F over the -30 to 180 deg F range. The sensing element shall be sealed for moisture protection. Provide a sun-shield mounted on a weatherproof outlet box for installation on outside walls or soffits.

Immersion Sensors: Brass socket with minimum insertion length of 2-1/2 inches. Operating range of 50 to 250 deg F for heating water applications, minimum accuracy of 0.5 deg F over full range.

Equipment Operation Sensors: As follows:

Status Inputs for Fans: Differential-pressure switch with adjustable range of 0 to 5 inches wg.

Status Inputs for Pumps: Differential-pressure switch piped across pump with adjustable pressure-differential range of 8 to 60 psi.

Status Inputs for Electric Motors and Certain Fans: Current-sensing relay with current transformers, adjustable and set to 175 percent of rated motor current. Use current sensors as noted on drawings.

Carbon Monoxide Sensors: Single or Multi-channel, dual level detectors, using solid-state sensors with 3-year minimum life, suitable for operating temperature range of 25 to 130 degrees F, calibrated for 25 PPM and 50 PPM with maximum 2 minute response time to 100 PPM co-calibration gas.

Carbon Dioxide Sensors: Single detector using solid-state infrared sensors, suitable for temperature range of 25 to 130 degrees F (indoor) or minus 20 to 110 degrees F (outdoor) as required. Calibrated for 0 to 2 percent with continuous or averaged output. Wall, duct or exterior mounting as required.

Differential Pressure Transmitters: Non-directional sensor with suitable range for expected input, temperature compensated. Accuracy shall be 2 percent of full scale with repeatability of 0.5 percent. 4-20 mA output. Duct or wall mounted as required.

Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual or automatic reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or lower than set point.

2.7 CONTROL VALVES

Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

Globe Valves NPS 2 and Smaller: Bronze body, bronze trim, rising stem,

renewable composition disc, and screwed ends with backseating capacity repackable under pressure. Valves shall have allowable media temperature of 20 deg F to 281 deg F to assure that the valve packing will have a long life (valves with narrower allowable media temperatures have no reserve packing capability for long term watertight seal).

Globe Valves NPS 2-1/2 and Larger: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.

Hydronic low temperature system globe valves shall have the following characteristics:

Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.

Internal Construction: Replaceable plugs and seats of stainless steel or brass.

Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom of guided plugs.

Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom of guided plugs.

Sizing: As noted on drawings.

Flow Characteristics: As noted on drawings. Operator shall close against full pump shutoff head.

Refer to Section 15184 for High Temperature Control Valve.

2.8 DAMPERS

Dampers: AMCA-rated, parallel or opposed blade design; form frames from not less than 0.1084-inch galvanized steel with mounting holes for duct mounting; damper blades not less than 0.0635-inch galvanized steel, with maximum blade width of 8 inches.

Blades secured to 1/2-inch diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass. Ends sealed against spring-stainless-steel blade bearings. Thrust bearings at each end of every blade.

Operating Temperature Range: From -40 to 200 deg F.

For standard applications as indicated, (as selected by manufacturer's sizing techniques) with optional closed-cell neoprene edging.

Airflow Station: Combination airflow station and control damper. Damper frame shall be 1/8-inch thick extruded aluminum with mounting flanges suitable for in-duct installation. Anodized monitoring blades are fitted within the damper frame and contain air pressure sensor ports. Jamb seals shall be flexible metal compression type. Blade seals shall be neoprene.

DBearings shall be molded synthetic. Maximum leakage is 2.0 cfm per SF with a 1-inch pressure differential across damper. Damper shall be suitable in operating environment of minus 40 to 140 degrees F. Maximum air pressure drop shall be 0.15 inches w.c. at 1000 feet per minute. Actuator shall be 24 VAC with 2-10 VDC control signal and a 2-10 VDC feed back signal. Provide necessary convertor from pulse width modulation input as required. Actuator shall fail closed (spring return). Integral digital controller shall monitor set point (input) and actual flow rate. Programming logic shall be stored in non-volatile EPROM. Monitoring accuracy shall be plus or minus 5 percent. Provide air straightening grid directly attached to damper frame and auxillary heater as noted.

2.9 ACTUATORS

Electronic Valve Operators: Select operator for full shutoff at maximum pump differential pressure. Actuator shall be floating point type suitable for use with associated TC.

Damper Operators: Size to operate with sufficient reserve power to provide smooth modulating or two-position action. Modulating dampers shall be floating point type suitable for use with the associated TC.

Spring return motor to fail in position indicated on control drawings.

Provide steel channel structural supports for any actuator installed on less than 16 gauge sheet metal.

2.10 CONTROL CABLES

Plenum rated in supply, return or exhaust air plenums

Sensor and control cable shall be suitable for sensor, TC and SC controllers used.

2.11 THERMOSTATS

Line-Voltage, ON-OFF Thermostats: Bimetal-actuated, open contact or bellows actuated, enclosed, nap-switch type, or equivalent solid-state type, with heat anticipator, integral manual ON-OFF-AUTO selector switch; UL listed for electrical rating.

Equip thermostats with OFF position on dial wired to break ungrounded conductors.

Dead Band: Maximum 2 deg F.

Electric Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.

Bulb Length: Minimum 20 feet.

Quantity: One (1) thermostat for every 20 sq. ft. of coil surface.

2.12 VARIABLE FREQUENCY DRIVE

The direct-fired make-up unit shall be specifically designed for variable volume operation. The unit manufacturer shall provide a variable frequency drive for remote, field mounting. Temperature Controls Contractor to provide variable frequency drive for AHU and relief fan control.

The variable frequency drive (VFD) shall be enclosed in a NEMA 1 enclosure and be configured for all mounting. The panel shall have key pad or touch screen for field adjustment of operating setpoints, manual override and operational status of unit. Include manual speed potentiometer, H-O-A, power light, drive run light.

The VFD shall have an input circuit breaker per UL 489 with a minimum of 10,000 amps symmetrical interrupting capacity. A convert stage per UL 508C shall change fixed voltage, fix frequency, AC line power to a fixed DC voltage. The converter shall use a full wave bridge rectifier. The converter shall be insensitive to 3-phase rotation of the AC line and shall not cause displacement power factor of less than 0.95 lagging under any speed or load condition.

An inverter stage shall change fixed DC voltage to variable frequency, variable voltage AC for motor speed control. The inverter shall be switched in a manner to produce a sinusoidal pulse width modulated output wave form.

An output wave form of 10 to 60 Hz is required. Minimum efficiency of VFD shall be 96 percent over full range of operation.

2.13 UTILITY INTERFACE

Energy Monitoring Meter (BTU-1): System shall include flow sensing device, temperature transmitters and control computer.

Flow Sensing Element: Averaging type differential pressure type. Element shall consist of three parts; a fabricated sensing tube with two-integral chambers. Sensing ports shall be arranged in accordance with Chebychev Calculus. Sensing element shall be rated for 500 psi at 1200 deg F. Sensing element shall be constructed of 316 stainless steel. Sensor shall be manufactured by Dieterich Standard, Contrec, Verabar or approved equal.

Differential Pressure Transmitter: "Smart" differential pressure transmitter as manufactured by Rosemont or approved equal. Transmitter shall output 4-20 ma signal.

Flow Computer: Microprocessor based design capable of displaying energy rate in engineering units, totalized energy and with ability of being programmed for available options, compensating functions and diagnostics. The flow computure shall be Dietrich Standard, Contrec, Verabar or approved equal.

Natural Gas Meter: Provide a natural gas meter EMCS interface with a scaled electrical pulse signal (switch closure or solid state type) for

each discrete unit of gas volume metered and/or an isolated 4-20 MA analog output. Meter shall have a self-averaging pitot tube with a multi-variable, microprocessor-based transmitter. Gas meter readings shall be temperature and pressure-compensated. Provide a 6-digit, non-reset, register which provides flow totalization in addition to the pulse output. Coordinate furnishing and installation with Mechanical Contractor.

Products: Dietrich - Standard Mass Probar or approved equal.

2.14 HEATING SYSTEM MAKEUP WATER METER

Manufacturers: Badger or approved equal.

Positive displacement flow meter, bronze housing, noryl chamber, nylon magnetic assembly and polyethylene screen. Maximum operating pressure 125 psi.

Unit mounted transmitter providing scaled pulse and 4-20 ma signal.

PART 3 EXECUTION

3.1 EXAMINATION

Verify that conditioned power supply is available to control units and global controller. Verify that field end devices, wiring, and pneumatic tubing are installed before proceeding with installation.

3.2 INSTALLATION

Install equipment as indicated to comply with manufacturer's written instructions.

Install software in control units, global controller and Host Computer (as required)

Provide customized programming to fully utilize the specified software. This includes, but is not limited to, things such as run time data on all equipment, maintenance scheduling, energy consumption tracking, energy conservation programming demand limiting, etc. It is the intent of this specification to provide the building users with an EMCS system that utilizes the full capabilities of the system with no programming by the user.

Programming and adjustments required during the building startup and warranty period shall be provided at no additional cost.

Verify location of thermostats and other exposed control sensors with plans and room details before installation. Locate 60 inches above floor.

Install averaging elements in ducts and plenums in crossing or zigzag pattern.

Install labels and nameplates to identify control components according to Division 15 Sections specifying mechanical identification.

The controls Contractor will be required to spend (8) hours assisting the test and balance (T&B) Contractor. Coordinate with T&B Contractor.

3.3 ELECTRICAL WIRING AND CONNECTIONS

Install raceways, boxes, building wire, cable, and cabinets as required and in accordance with N.E.C.

SInstall signal and communication cable as required.

Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.

Install exposed cable in raceway.

Install concealed low voltage cable in plenum. No EMT carrier required.

Bundle and harness multiconductor instrument cable in place of single cables where a number of cables follow a common path.

Fasten flexible conductors, bridging cabinets and doors, neatly along hinge side; protect against abrasion. Tie and support conductors neatly.

Number-code or color-code conductors, except local individual room controls, for future identification and servicing of control system.

Connect electrical components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening requirements specified in UL 486A.

Connect manual reset limit controls independent of manual control switch positions.

Connect HAND-OFF-AUTO selector switches to override automatic interlock controls when switch is in HAND position.

3.4 APPLICATION SOFTWARE DOCUMENTATION

Provide blueprint documentation of the software application program for each DDC. Documentation provided shall include block software flowchart showing the interconnection between each of the control algorithms and sequences. For systems utilizing program listings, a program listing shall be printed onto the same blueprint, along with the program flowchart, and description of the sequence of operation. This blueprint shall be stored and maintained in each DDC device panel. System acceptance shall not be completed until this documentation is provided and located in each panel.

Provide a copy of all databases on floppy disk or tape backup. Provide a floppy disk copy of all graphic screens created for the project.

3.5 ACCEPTANCE TESTING

Point Verification:

To verify end-to-end operation of the system, provide a hard copy of All Points Summary Listing to the Government of each part or system to be placed in warranty by the Government.

Sequence Verification:

The Contractor shall notify the Government's representative when the systems are performing all specified sequences. The Contractor shall demonstrate to the Contracting Officer every specified feature of the DDC system, the Contracting Officer shall verify all sequences of operation and allow the system to be placed into warranty acceptance test.

The warranty acceptance test shall be of 7 days duration and the system shall perform as follows:

During the 7 days, the EMCS system shall not report any system diagnostics from the subsystem under test.

The subsystem shall be performance verified as operational using temporary trends of each control loop located in the SDC. During the occupied periods, EMCS control loops under test shall maintain control of the process variable within the following scales:

Pump Head Pressure	+/- 10% of control range
Duct Temperature Loop	+/- 2 degrees F
Pipe Temperature Loops	+/- 2 degrees F

The Contractor shall provide a hard copy printout of the process variable, process variable setpoint and control loop output % for the period of 2 hours prior to occupancy to 2 hours after occupancy with samples taken every 15 minutes.

3.6 DEMONSTRATION

Manufacturer's Field Services: Provide the services of a factory-authorized service representative to demonstrate and train Government's maintenance personnel as specified below.

Train Government's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

Schedule training with Government with at least 7 days notice.

Provide operator training on data display, alarm and status descriptors, requesting data, execution of commands, and request of logs. Include a minimum of 20 hours dedicated instructor time on-site, 8 hours at project close out and 16 hours at end of 1-year warranty

period.

Variable Frequency Drive: Install variable frequency drives where shown on drawings. Install in strict accordance with manufacturer's written installation drawings. Coordinate with Electrical Contractor accordingly.

3.7 SEQUENCE OF OPERATION

3.7.1 AHU-1

AHU-1 and exhaust fan EF-5 shall run continuously during occupied hours. When indexed to the occupied mode, the outside air damper (D-1) shall open and maintain the minimum outside airflow rate of 1,200 CFM. The discharge air control scheme shall maintain a deck temperature of 55 deg F by sequencing the economizer dampers and air-cooled condensing units (ACCU-1 & ACCU-2). When outside air temperature is less than 60 degrees F, the economizer damper (D-1) and return damper (D-2) shall modulate as required to maintain discharge air temperature. Provide sufficient dead band between ACCU-1 and ACCU-2 operation to prevent excessive cycling of compressors.

The supply air volume shall modulate in response to duct static pressure. Initial setpoint shall be 3/4-inch W.C., with the final setpoint being established in the test and balance procedure.

Upon the discharge air temperature dropping below 38 Deg F (adj), the outside air damper shall close and the fan shall de-energize. An alarm shall be sent to the base central CPU.

When the duct discharge static pressure exceeds 4 inches W.C., the fan shall de-energize and the outside air damper shall close. An alarm shall be sent to the base central CPU.

The system shall continuously monitor and record carbon dioxide levels of the separate zones and the outside air. When any zone CO level exceeds 700 PPM above ambient, the outside air damper shall modulate open.

The system shall be capable of emergency shut down as per Base Force Protection requirements. Upon a shut down call, the supply fan and related exhaust fans shall close and any outside air, exhaust or relief dampers shall close.

3.7.2 Room Terminal Units, VAV Boxes and Finned Tube Baseboard

Upon a call for cooling, the VAV damper shall modulate open in proportion to space temperature, setpoint differential. Upon a call for heating, the VAV damper shall modulate to its minimum position. Upon a further call for heating, the two-way, equal percentage valve shall modulate open. Upon a further call for heat, the two-way, equal percentage finned tube control valve shall modulate open (on zones such equipped). On interior zones requiring additional heat, the VAV damper shall modulate open to its scheduled heating CFM

Night heating requirements will be met by finned tube baseboard. In the event that an interior zone requires nighttime heating, the central AHU

shall energize and the VAV box reheat coils shall modulate as required. The central fan shall run for a minimum of 15 minutes to prevent rapid cycling of the fan. The outside air damper shall remain closed during night heating operations.

The system shall employ an optimum start/stop control sequence for morning warmup.

Room setpoints shall be as follows:

Heating = 72 Deg F
Cooling = 76 Deg F
Setback = 62 Deg F

All control and monitoring points shown on the temperature controls schematics shall be shown on the base central CPU.

3.7.3 RF-1

The relief fan shall only be allowed to operate when AHU-1 is in operation.

A space mounted differential pressure transmitter shall continuously monitor building static pressure. Upon building static reaching 0.05-inch W.C., the two-position relief damper (D-3) shall open. Upon a further rise in building static to 0.08-inch W.C., the relief air fan shall energize and the VFD shall modulate fan speed as required to maintain 0.08-inch W.C. Upon building static reaching 0.05-inch W.C., the fan shall de-energize.

All control and monitoring points shown on the temperature controls schematics shall be shown on the base central CPU.

3.7.4 AGE Ventilation System

This area consists of two distinct ventilation systems. The general exhaust fan (EF-1) shall run continuously during occupied hours. The vehicle exhaust fan (EF-3) shall be controlled by Users. The variable air volume, direct-fired makeup air unit shall monitor space pressure via a differential pressure transmitter. Upon space pressure dropping below negative 0.05-inch W.C. the makeup air unit shall energize and provide tempered outside air to the space. As AGE exhausts are energized the makeup air unit shall provide sufficient replacement air for the space.

Carbon monoxide and carbon dioxide levels shall be continuously monitored by the central CPU. In addition, a dedicated vehicle exhaust control system shall initiate a purge ventilation scheme when CO/CO2 levels exceed 50 PPM/1,200 PPM respectively for 15 minutes. Upon levels reaching these setpoints, EF-2 shall energize to low speed and the two-position outside air damper on IH-2 shall open. If after 15 minutes, the levels do not drop below setpoint, EF-2 shall go to high speed.

When EF-2 is indexed to high speed, the alarm light on the local controller shall illuminate. Upon initiation of first stage of ventilation, the local audio alarm shall sound and an alarm shall be sent to the base central CPU.

All control and monitoring points shown on the temperature controls schematics shall be shown on the base central CPU.

The system shall be capable of emergency shut down as per Base Force Protection requirements. Upon a shut down call, the supply fan and related exhaust fans shall close and any outside air, exhaust or relief dampers shall close.

3.7.5 Heating Plant

The lead heating water circulating pump (HWP-1 or HWP-2) shall energize whenever the outside air temperature is below 60 deg F. The high temperature heating valve shall modulate as required to maintain heating water supply temperature as per the following reset schedule.

OAT (Deg F)	HWS Temp (Deg F)
60	110
0	180

Maximum HWS temperature shall be 180 deg F. Upon the outside air temperature reaching -10 Deg F the lag pump shall energize and the two pumps shall operate in parallel.

The energy meter shall record high temperature hot water use used by the facility. The makeup water meter shall monitor total amount of makeup water introduced to the system. This meter shall be reset to zero after initial fill. Upon the makeup water volume reaching 10% of the initial fill, an alarm shall be sent to the base central CPU indicating dilution of glycol medium.

All control and monitoring points shown on the temperature controls schematics shall be shown on the base central CPU.

3.7.6 Blower Coils

BC-1 and BC-2: These systems shall be controlled by the building occupancy schedule. When indexed to the occupied mode, the supply fan shall energize and the outside air damper shall open. Space heating requirements shall be met by modulating three way valve.

When indexed to the occupied mode, the outside air damper shall close. Night setback heating requirements shall be met by cycling the fan operation of the heating valve. The outside air damper shall remain closed during unoccupied heating.

BC-3: This system is a makeup unit for the grinding bench exhaust fan. When EF-6 is energized, BC-3 outside air damper shall open and prove open with end switch, then the supply fan shall start. Discharge air shall be controlled to 65 degrees F (field adjustable) through modulation of three-way control valve.

All control and monitoring points shown on the temperature control

schematics shall be shown on the central CPU.

The system shall be capable of emergency shut down as per Base Force Protection requirements. Upon a shut down call, the supply fan and related exhaust fans shall close and any outside air, exhaust or relief dampers shall close.

3.7.7 Miscellaneous Control Devices

CF-1 and HUH-1. A single line or low voltage heating and cooling thermostat shall control both of these devices in the mechanical room. Upon space temperature dropping below 55 Deg F, the unit heater fan shall energize. A strap on aquastat shall prevent unit operation if the heating water supply temperature is below 100 Deg F. When space temperature reaches 90 Deg F, the cooling fan shall energize

Cabinet heaters. A line or low-voltage thermostat shall cycle unit fans when space temperature drops below 60 Deg F. A strap on aquastat shall prevent unit operation if the heating water supply temperature is below 100 Deg F.

Cooling Fan CF-2. A line or low voltage thermostat shall energize cooling fan when space temperature reaches 90 deg F.

Radiant Heaters. A two-stage, line or low-voltage thermostat shall energize the two-stage heaters when space temperature drops below 65 Deg F.

Induced Draft Fan: Provide necessary devices to perform listed sequence. Coordinate with equipment manufacturer on factory furnished devices. When pressure washer is indexed to pump or burner mode, the damper in the exhaust stack shall open and prove open with end switch. The induced draft fan shall energize and prove draft with differential press switch. Then the prssure washer shall energize. All inherent safety devices will not be overridden by this sequence.

3.7.8 Utility Meter Interface

The building's electrical, water, natural gas and high temperature hot water consumption will be monitored. Coordinate with base EMCS staff.

3.7.9 Energy Monitoring

The following information shall be continuously monitored:

- AHU-1, Supply fan energy consumption.
- AHU-1, Air flow rate (CFM).
- AHU-1, Economizer operation.
- AHU-1, Supply duct static pressure.
- AHU-1, Outside (ventilation) air flow rate (CFM).
- AHI-1, Carbon dioxide levels. See plans for quantity.
- RF-1, Relief fan energy consumption.
- RF-1, Relief fan air flow rate (FM).
- RF-1, Building static pressure.
- EF-1, Energy consumption.
- EF-2, Energy consumption.

EF-5, Energy consumption.
BC-1, Blower coil supply fan energy consumption.
BC-2, Blower coil supply fan energy consumption.
Heating plant high temperature energy use.
HWP-1, Heating water pump energy use.
HWP-2, Heating water pump energy use.
Natural gas consumption (via main meter).
Domestic water use.
Irrigation water use.

-- End of Section --

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SECTION 15940

OVERHEAD VEHICLE TAILPIPE EXHAUST REMOVAL SYSTEM(S)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 210 (1999) Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

AMCA 300 (1996) Reverberant Room Method for Sound Testing of Fans

AIR-CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI Guideline D (1996) Application and Installation of Central Station Air-Handling Units

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 11 (1990; R 1999) Load Ratings and Fatigue Life for Roller Bearings

ABMA 9 (1990; R 2000) Load Ratings and Fatigue Life for Ball Bearings

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8 (1992) Filler Metals for Brazing and Braze Welding

ASME INTERNATIONAL (ASME)

ASME B16.21 (1992) Nonmetallic Flat Gaskets for Pipe Flanges

ASME BPVC SEC IX (2001) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

ASTM INTERNATIONAL (ASTM)

ASTM A 167 (1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A 193/A 193M	(2003) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 307	(2002) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 36/A 36M	(2003a) Carbon Structural Steel
ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 924/A 924M	(1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B 117	(2002) Operating Salt Spray (Fog) Apparatus
ASTM B 32	(2003) Solder Metal
ASTM E 437	(1992; R 1997) Industrial Wire Cloth and Screens (Square Opening Series)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2003) Motors and Generators
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SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA Rnd Duct Const	(1999, 2nd Ed) Round Industrial Duct Construction Standards
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1.2 COORDINATION OF TRADES

Ductwork offsets, fittings, and any other accessories required shall be furnished as specified to provide a complete exhaust system installation and to eliminate interference with other construction.

1.3 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be housed in a manner to preclude any damage from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all ductwork, flexible connections and pipes shall either be capped or plugged until installed.

1.4 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.5 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Exhaust System Related Submittals

A list of the Exhaust System Related Submittals, no later than 7 days after the approval of the Exhaust System Specialist.

Ductwork Components

Materials and Equipment

Manufacturer's catalog data included with the Exhaust System Drawings for all items specified herein. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with all contract requirements. In addition, a complete equipment list that includes equipment description, model number and quantity shall be provided.

SD-10 Operation and Maintenance Data

Exhaust System Operation and Maintenance Manuals

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 14 days prior to on-site training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment.

1.6 JOB REQUIREMENTS

The Contractor shall construct, complete and operational, exhaust system(s) as specified herein. The exhaust system(s) shall provide adequate air exhaust quantities and velocities. All duct shall be properly sized for pressure loss and adequate velocity including locating intakes, ductwork size, layout, equipment and controls. Construction of the exhaust system shall be based on the referenced publications, and other provisions as specified herein.

1.6.1 Detail Drawings

The Contractor shall submit Detail Drawings consisting of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and

installation instructions. Detail drawings shall also contain complete duct, wiring, and schematic diagrams and any other details to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment in relation to other parts of the work including clearances required for maintenance and operation.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Where an integrated, packaged exhaust system is furnished, all items will be the product of the system manufacturer. System component parts may be by other manufacturers.

2.2 ASBESTOS PROHIBITION

Asbestos and asbestos-containing products shall not be used.

2.3 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.4 CONTROLS

Controls shall be provided as specified in Section 15905 BASEWIDE ENERGY MANAGEMENT AND CONTROL SYSTEM (EMCS) -- HSQ SYSTEM

2.5 DUCTWORK COMPONENTS

2.5.1 General

Duct shall be constructed of galvanized sheets of the minimum gauge thickness for ducts as required in SMACNA Rnd Duct Const. Ducts shall be constructed and sealed in accordance with SMACNA Rnd Duct Const for a negative pressure of 6 inch water gauge static pressure. Ducts, unless otherwise approved, shall be round with longitudinal lock seam and conform to the dimensions indicated. Ducts shall be straight and smooth on the inside with airtight joints. Where ducts with crimped ends are used to make up joints, the joints shall have crimp and bead. The bead shall provide a rigid stop for the mating open end to seat against. Steel spiral wound duct is not acceptable.

2.5.2 Fittings

Reducing fittings shall have a minimum of 1 inch increase in diameter per 8 inches in length. Elbows shall have a centerline radius of not less than 1-1/2 times the diameter. Branches shall stub into mains at main expansion points at an angle of not more than 30 degrees with the centerline of the main duct in the direction of air flow, unless otherwise indicated or

approved. Where riser ducts with single or multiple inlets are indicated, the riser duct shall connect into the bottom of the main duct at an angle as specified for branches. Where flexible connections connect to the main duct, the duct branch takeoff or stub shall be braced with approved metal straps or members.

2.5.3 Cleanout

Cleanout shall be provided on the end of the main ductwork opposite the end of the fan suction connection. The cleanout opening shall be sized to the approximate inside area of the duct. Removable airtight caps or flange type covers of minimum gauge thickness as the main duct shall be provided. Other cleanout openings shall be provided where indicated.

2.5.4 Apparatus Connections

Where sheet metal connections are made to fan suction and discharge, or where ducts of dissimilar metals are connected, an approved noncombustible flexible connection approximately 6 inches wide shall be installed and securely fastened by zinc-coated steel clinch-type draw bands for round ducts. For rectangular ducts the flexible connections locked to metal collars shall be installed using normal duct construction methods.

2.5.5 Duct Test Holes

Test holes with covers shall be provided where indicated, directed, or where necessary in ducts and plenums for using Pitot tubes for taking air measurements to balance the air systems.

2.5.6 Duct Sleeves and Framed Openings

Duct sleeves shall be provided for all round ducts 15 inch diameter or less passing through floors, walls, ceilings, or roofs. Sleeves in non-load bearing walls shall be fabricated of 20 gauge steel sheets conforming to ASTM A 924/A 924M. Sleeves in load-bearing walls shall be fabricated of standard-weight galvanized steel pipe conforming to ASTM A 53/A 53M. Round ducts larger than 15 inch diameter and all square and rectangular ducts passing through floors, walls, ceilings, or roofs shall be installed through framed openings. Structural steel members for framed openings shall conform to ASTM A 36/A 36M. Framed openings shall provide 1 inch clearance between the duct and the opening. Closure collars of galvanized steel not less than 4 inches wide shall be provided on each side of walls or floors where sleeves or framed openings are provided. Collars for round ducts 15 inch diameter or less shall be fabricated from 20 gauge galvanized steel. Collars for round, square or rectangular ducts with minimum dimension over 15 inches shall be fabricated from 18 gauge galvanized steel.

2.6 EXHAUST HOSE SYSTEM

2.6.1 Tailpipe Adapters

Adapters shall be of the tapered-cone type with spring clips or other suitable devices for exhaust pipe attachment. The adapter shall fit 6-inch nominal diameter exhaust pipe.

2.6.2 Flexible Exhaust Hose

Flexible exhaust hose shall be approved heat-resistant wire-reinforced glass fiber and neoprene tubing. Flexible tubing inside diameter and length shall be as shown. The tubing shall be connected to the bottom of the ductwork. A flanged connection shall be provided where the flexible tubing and overhead ductwork are joined. The flanged connection shall consist of steel flanges not less than 0.078 inch thick, 1/8 inch gasket. The gasket shall be suitable for the system design temperature shown, in accordance with ASME B16.21, full face or self-centering flat ring type. It shall contain aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR). The flange shall be sized or designed to suit the hose as approved. The connection of the neoprene hose may be installed with an approved hose clamp or as recommended by the manufacturer.

2.6.3 Exhaust Hose Suspension System

The exhaust hose suspension system shall suspend the flexible tubing overhead when not in use; allowing it to be lowered to the operating level, when required. The suspension system shall be furnished complete with cable, and operating mechanism. The suspension system shall be [counter-weighted type] or [manually operated balancer type with safety ratchet lock or automatic brake having slip resistant hand grip].

2.7 DAMPERS

Dampers shall be of the type indicated and installed where shown. Dampers shall be of the circular disk type with quadrant locking device or blast gate type. Damper blades shall be not less than 16 gauge thickness of stainless steel. Blast gate dampers shall be two piece construction with adjustable sliding gate and setscrew.

2.8 MATERIALS AND EQUIPMENT

Materials and equipment shall conform to the following requirements.

2.8.1 Screen

ASTM E 437, type and class as required for the application.

2.8.2 Iron and Steel Sheets

2.8.2.1 Galvanized Iron and Steel

ASTM A 924/A 924M, Coating Designation G90.

2.8.2.2 Stainless Steel

ASTM A 167, Type 304.

2.8.3 Steel Structural Shapes

ASTM A 36/A 36M.

2.8.4 Solder Silver

AWS A5.8, brazing alloy; grade to suit application.

2.8.5 Solder

ASTM B 32, composition to suit application.

2.8.6 Bolts and Nuts

Bolts and nuts, except as required for high temperature exhaust applications, shall be in accordance with ASTM A 307. Bolts and nuts used for exhaust applications where the temperature of the bolt may rise above 400 degrees F or used as flange bolts in corrosion resistant material shall be in accordance with ASTM A 193/A 193M Class 2. The bolt head shall be marked to identify the manufacturer and the standard with which the bolt complies in accordance with ASTM A 307 or ASTM A 193/A 193M as applicable.

2.9 ELECTRICAL WORK

Electrical motor-driven equipment specified shall be provided complete with motor, motor starter, and controls. Electrical characteristics and enclosure type shall be as shown. Unless otherwise indicated, motors of 1 hp and above shall be high efficiency type. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary. Each motor shall be according to NEMA MG 1 and shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices, but not shown, shall be provided. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controller may be provided to accomplish the same function. Solid-state variable-speed controllers shall be utilized for motors rated 10 hp or less. Adjustable frequency drives shall be used for larger motors.

2.10 AIR MOVING DEVICES

2.10.1 General

Fans shall be tested and rated in accordance with the standards of AMCA 210, Type "D" Ducted Inlet, Ducted Outlet Configuration. Where V-belt drives are used, such drives shall be designed for not less than 150 percent of the connected driving capacity, and motor sheaves shall be adjustable to provide not less than an overall 20 percent speed variation. Sheaves shall be selected to drive the fan at such speed as to produce the specified capacity when set at the approximate midpoint of the sheave adjustment. Motors for V-belt drives shall be provided with adjustable rails or bases. Fans shall be provided with personnel screens or guards on both supply ends except where ducts or dampers are connected to the fan. Fans and motors shall be provided with vibration isolation supports or mountings. Vibration isolation units shall be standard products with published load ratings, and shall be single rubber-in-shear, neoprene coated fiberglass,

double rubber-in-shear springs, or springs under inertia base. Each fan shall be selected to produce the capacity required at the fan total pressure indicated. Standard AMCA arrangements shall be provided unless otherwise indicated and the rotation and discharge shall be as indicated. Fans shall have nonoverloading characteristics. Fan housing shall be constructed with not less than 16 gauge thickness of steel. Fan impellers shall be constructed to meet AMCA Spark Resistance "B" Classification and accurately balanced both statically and dynamically when installed in the assembled fan unit. Impeller and housing in the air stream shall be coated with neoprene, epoxy, phenolic resins, or otherwise be suitable to resist the corrosive gases and temperatures produced. Fans shall be free of objectionable vibration or noise. Certified performance curves indicating that the fan supplied will operate in its most efficient operating range will be provided. In addition, "sound power" ratings shall be furnished with each fan. Fans indicated to be mounted on exterior of building shall be provided with weatherproof covers for the motor drive unit or other weatherproofing as recommended by the manufacturer. Each fan shall be selected to produce the capacity required at the fan total pressure indicated. Weather hoods, flashing, and bird screens shall be provided where indicated.

2.10.2 Fans

The sound power level shall be as indicated and values shall be obtained according to AMCA 300. Standard AMCA arrangement, rotation, and discharge shall be as indicated. Fans shall be tested and rated according to AMCA 210.

Each fan shall be selected to produce the capacity required at the fan static pressure indicated. Fans may be connected to the motors either directly or indirectly with V-belt drive. V-belt drives shall be designed for not less than 150 percent of the connected driving capacity. Motor sheaves shall be variable pitch for 15 hp and below and fixed pitch as defined by ARI Guideline D. Variable pitch sheaves shall be selected to drive the fan at a speed which will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, a replaceable sheave shall be provided when needed to achieve system air balance.

2.10.2.1 Protective Devices

Motors for V-belt drives shall be provided with adjustable rails or bases. Removable metal guards shall be provided for all exposed V-belt drives, and speed-test openings shall be provided at the center of all rotating shafts.

Fans shall be provided with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan. Fan and motor assemblies shall be provided with vibration-isolation supports or mountings as indicated. Vibration-isolation units shall be standard products with published loading ratings.

2.10.2.2 Centrifugal Fans

Centrifugal fans shall be fully enclosed, single-width single-inlet, or double-width double-inlet, AMCA Pressure Class I, II, or III as required or indicated for the design system pressure. Impeller wheels shall be rigidly

constructed, accurately balanced both statically and dynamically. Fan blades may be forward curved, backward-inclined or airfoil design in wheel sizes up to 30 inches. Fan blades for wheels over 30 inches in diameter shall be backward-inclined or airfoil design. These fans shall be suitable for the temperatures encountered. The fan shaft shall be provided with a heat slinger to dissipate heat buildup along the shaft. An access (service) door to facilitate maintenance shall be supplied with these fans.

Fan wheels over 36 inches in diameter shall have overhung pulleys and a bearing on each side of the wheel. Indirect drive fan wheels 36 inches or less in diameter may have one or more extra long bearings between the fan wheel and the drive. Bearings shall be sleeve type, self-aligning and self-oiling with oil reservoirs, or precision self-aligning roller or ball-type with accessible grease fittings or permanently lubricated type. Grease fittings shall be connected to tubing and serviceable from a single accessible point. Bearing life shall be L50 rated at not less than 200,000 hours as defined by ABMA 9 and ABMA 11. Fan shafts shall be steel, accurately finished, and shall be provided with key seats and keys for impeller hubs and fan pulleys. Each fan outlet shall be of ample proportions and shall be designed for the attachment of angles and bolts for attaching flexible connections. Motors, unless otherwise indicated, shall not exceed 1800 rpm and shall have open totally enclosed enclosures.

2.11 FACTORY COATING

Equipment and component items, when fabricated from ferrous metal as defined by ASTM (or similar) standard, shall be factory finished with the manufacturers standard finish except that items located outside of building shall have weather-resistant finishes that will withstand 500 hours exposure to the salt spray test specified in ASTM B 117.

PART 3 EXECUTION

3.1 INSTALLATION

Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.

3.2 EXHAUST SYSTEM INSTALLATION

3.2.1 General Requirements

Welding and brazing shall conform to ASME BPVC SEC IX. Horizontal sections of the main duct shall be installed with the longitudinal lock seam on the top. Slip joints shall be sealed in accordance with SMACNA Rnd Duct Const.

Riser duct shall be supported and anchored to the structure as indicated. Main duct shall be attached to the structural members of the building as recommended by SMACNA Rnd Duct Const.

3.2.2 Building Surface Penetrations

Sleeves or framed openings shall be utilized where duct penetrates building surfaces. Penetrations shall be sealed. The space between the sleeve or framed opening and the duct shall be packed with mineral wool or other approved material. Closure collars shall be installed around the duct on

both sides of the penetrated surface. Collars shall fit tight against the building surfaces and snugly around the duct.

3.3 FINAL ACCEPTANCE TESTS

Each exhaust system and inlet shall be balanced to produce the indicated air quantities within 10 percent at the conditions shown. Control devices shall be set to control at the points indicated or directed. Bearings shall be lubricated, and the speed, direction or rotation of each fan shall be checked. The running current of each motor shall be checked. Upon completion, and prior to acceptance of the installation, the exhaust system shall be tested at operating conditions to demonstrate satisfactory functional and operating efficiency. Operating tests shall cover a period of not less than 2 hours for each system, and all tests shall be conducted in the presence of the Contracting Officer. If tests do not demonstrate satisfactory operation of the exhaust system, deficiencies shall be corrected and retested. All instruments, facilities, and labor required to properly conduct the tests shall be provided by the Contractor. The electricity required for testing will be furnished by the Government.

3.4 ON-SITE TRAINING

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total 8 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The field instructions shall cover all of the items contained in the approved operation and maintenance manuals, as well as demonstrations of routine maintenance operations. The Contracting Officer shall be notified at least 14 days prior to date of proposed conduction of the training course.

-- End of Section --

SECTION 15950

TESTING, ADJUSTING AND BALANCING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 111 (1998) Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1 (2002) National Standards for Total System Balance

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB TABES (1998) Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA TAB HVAC SYSTEMS (2002) HVAC Systems - Testing, Adjusting and Balancing

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Records of Existing Conditions shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

SD-03 Product Data

Equipment and Performance Data shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

SD-06 Test Reports

Test Reports shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

SD-07 Certificates

Certificates shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

1.3 GENERAL REQUIREMENTS

Section 15003, "General Mechanical Provisions," applies to work specified in this section.

Records of Existing Conditions shall be submitted consisting of the results of Contractor's survey of work area conditions and features of existing structures and facilities within and adjacent to the jobsite. Commencement of work shall constitute acceptance of existing conditions.

Equipment and Performance Data shall be submitted for instruments and equipment to be used during testing.

Test Reports shall be submitted to the Contracting Officer for approval. Six bound copies of the testing, adjusting, and balancing report shall be provided.

Certificates shall be submitted by the Contractor showing independent laboratory certification of test-apparatus calibration data, dated after the award of the contract.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 DESIGN REVIEW

The Test and Balance Contractor shall review the contract plans and specifications and advise the Contracting Officer of any deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation or prevent the effective test and balance of such systems

The Test and Balance Contractor shall obtain all necessary shop drawings and submittals from Mechanical Contractor as required. Coordinate all testing and balancing with all trades and Commission Authority as required.

3.2 AIR AND HYDRONIC SYSTEMS TESTING AND ADJUSTMENT

Operational balancing and adjustment of air-handling and hydronic systems shall be performed under the direction of an independent balancing agency whose field representative is a registered professional engineer. All work

shall be done in accordance with NEBB TABES, ASHRAE 111, AABC MN-1 or SMACNA TAB HVAC SYSTEMS, where applicable, the requirements of the contract documents, and in the presence of the Contracting Officer.

Government reserves the right to require recalibration of any or all test apparatus in accordance with the frequency recommended by the component manufacturer, or when reasonable doubt of accuracy exists.

Hydronic systems structural and leakage testing shall be performed in accordance with requirements specified herein under "Water Systems Testing."

Air-handling systems structural and leakage testing shall be performed in accordance with requirements specified herein under "Air-Handling System Testing."

Components of the various air systems shall be adjusted to operate within the design and operating characteristics published by the equipment manufacturer. Government will require the services of an authorized representative of the manufacturer if the Contractor is unable to adjust any equipment.

Equipment shall not be operated until properly lubricated and brought into specified service condition.

Air- and hydronic-system final adjustments shall be permanently marked to be readily restorable if disturbed.

Systems acceptance is predicated upon successful completion of specified work, receipt by the Contracting Officer of certified data summarizing the performance of all systems within design intent, and approval thereof. Data shall be arranged by system and identified by apparatus and item, using standard forms, where possible, and supplementing with reasonable facsimiles, where necessary.

3.2.1 Air-Handling Systems

3.2.1.1 Balancing, Adjustment, and Acceptance Criteria

Final volume conditions for all systems shall be within the following limits:

Primary air delivery: Plus or minus 10 percent of design cfm at design temperature.

3.2.1.2 Balancing and Adjustment, Apparatus and Procedures

Balancing and adjustment apparatus and procedures shall be in accordance with NEBB TABES.

Balancing and adjustment apparatus and procedures shall be in accordance with NEBB TABES.

Instrumentation shall be provided to record air movement data, motor kilowatt (kW) input, and power factor. If motor identification plate

current value is exceeded, the next size larger motor, starter, and wiring (if necessary) shall be provided.

3.2.1.3 Test Reports

Test reports shall be provided on all systems tested together with test-apparatus data and air-diffusion device flow coefficients, and the following:

- Air-handling apparatus data

- Exhaust-fan data

- Air-diffusion devices data

- Duct-traverse data for the following:

 - Main supply duct

 - Main exhaust duct

 - Outside air-intake duct

 - Other ducts as indicated

- Filter apparatus data, including visual condition, inlet pressure, and differential pressure for each filter installation

- Coil data, including visual condition, inlet pressure, and differential pressure for each coil installation

- Pressure at inlet to face zone duct on multizone units

3.2.2 Hydronic Systems

3.2.2.1 System Balancing, Adjustment, and Acceptance Criteria

Systems final flow conditions shall be within the following limits:

- Flow-station delivery: Plus or minus 10 percent of design gpm at design temperature

3.2.2.2 Test Apparatus and Procedures

Test apparatus shall consist of devices required for hydronic systems flow measuring and balancing including:

- Pressure gages and fittings

- Dry bulb thermometers

- Balancing-cock adjustment wrenches

- Differential-pressure gages or manometers

- Thermometer wells, where necessary for balancing, but where permanent installation of thermometers is not indicated or required

Complete air balance shall have been accomplished before water balance begins.

3.2.2.3 Hydronic Systems Preparation

Hydronic systems shall be prepared in the following manner:

Proper installation of valves and balancing devices shall be verified.

Valves shall be opened to full-open position, including coil-stop valves, bypass valves, and return-line balancing cocks.

Strainer screens shall be removed and cleaned.

Water in each system shall be examined to determine that it has been treated.

Rotation of pumps shall be checked only after obtaining approval.

Expansion tanks shall be checked to determine that they are not air-bound and that system is full of water.

Air vents shall be checked at high points to verify proper installation and operation.

Temperature controls shall be set so that coils are on full cooling. Automatic bypass valves at coils and liquid chiller should close. Follow the same procedure when balancing heating coils are set on full heating.

Water-circulating pumps shall be set to proper gpm delivery.

Water flow through convertors shall be adjusted.

Water temperature shall be checked at inlet side of cooling and heating coils. Note rise or drop of temperature from source.

Next, each coil shall be balanced.

Upon completion of flow reading and adjustment of coils, all settings shall be marked and all data recorded.

After adjustments to coils have been made, settings at pumps, chiller, and convertors shall be rechecked and readjusted if required.

Pressure drop through coils shall be measured at set flow rate on call for full cooling and on full heating.

Pressure drop across bypass valve shall be set to match coil full-pressure drop to prevent unbalanced flow conditions when coils are on full bypass.

Same procedure on chiller to adjust chiller bypass valves shall be

followed.

Instrumentation shall be provided to record apparatus motor kW input and power factor. If motor identification plate current capacity and larger starter is exceeded, next-size larger motor and wiring shall be provided, as necessary.

3.2.2.4 Operational Test Report

Operational test report shall provide data on systems tested, test apparatus data, and orifice or Venturi data, and shall include:

For each heating and cooling element:

Inlet water temperature

Leaving water temperature

Inlet air temperature

Leaving air temperature

Pressure drop across each element

Pressure drop across bypass valve

Calculated and measured flow rates through coils and radiation elements

For each pump:

Balanced-condition suction and discharge pressures

Flow rate

Mechanical specifications of unit

Rated and actual kW input and power factor

For each apparatus such as chiller, cooling tower, and converter:

Inlet water temperature

Leaving water temperature

Pressure drop across units

Calculated and measured waterflow

Mechanical specifications of units

Rated and actual kW input and power factor for motors

Heating- and cooling-element data

Pump data

3.2.3 System and Temperature-Control Adjustment

3.2.3.1 Adjustment and Acceptance Criteria

After balance and adjustment operations have been completed, the system shall be tested as a whole to see that components perform as an integral part of the system and that temperature and conditions are evenly controlled. Corrections and adjustment shall be made as necessary to meet the specified design requirements.

3.2.3.2 System Test Report

Test report shall be provided on the system and shall include:

Outdoor temperature

Room-by-room temperature and humidity conditions (center of cooled area at table top)

Calculation for total British thermal units per hour (Btu/hr) cooling required, including time of day and dry bulb outside temperature

Calculation for total Btu/hr heating required, including time of day and dry bulb outside temperature

3.3 TEST REPORTS

Final test reports shall be provided to the Contracting Officer. Reports shall have a cover letter/sheet clearly marked with the System name, Date, and the words "Final Test Reports - Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database."

-- End of Section --

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15995

MECHANICAL SYSTEMS COMMISSIONING

PART 1 GENERAL

1.1 DESCRIPTION

The purpose of this section is to specify Division 15 responsibilities in the commissioning process.

The systems to be commissioned are listed in Section 15996.1.6.

Commissioning requires the participation of Division 15 to ensure that all systems are operating in a manner consistent with the contract documents. The general Cx requirements and coordination are detailed in Division 17. Division 15 shall be familiar with all parts of Division 17 and the Cx Plan (see below). Division 15 shall execute Cx responsibilities assigned to them in these Contract Documents.

1.2 RESPONSIBILITIES

Mechanical, Controls and TAB Contractors. The Cx responsibilities applicable to each of the mechanical, controls and TAB contractors of Division 15 are as follows (all references apply to commissioned equipment only):

Construction and Acceptance Phases:

Include and itemize the cost of commissioning in the contract price. In each purchase order or subcontract written, include requirements for submittal data, O&M data and training. Note that submittal data shall be used to begin the O&M manuals immediately after approval by the A/E.

First drafts of the O&M manuals are due 30 days after the arrival of the last piece of equipment on site.

Attend the initial Cx "Scoping meeting" and periodic meetings necessary to facilitate the Cx process. Periodic meetings will be held monthly after the initial scoping meeting, and will be held weekly in conjunction with the on-site construction meeting during the final stages of construction.

Contractors shall provide normal cut sheets and shop drawing submittals of commissioned equipment through the communication channels outlined in Division 1.

Typically this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, fan and pump curves, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation, start-up and checkout materials that are actually

shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the CA.

The CA may request further documentation necessary for the commissioning process.

This data request may be made prior to normal submittals.

Provide a first-draft copy of the O&M manuals for the Engineer and CA to review 30 days after the receipt of the last piece of equipment. Note that submittal data shall be used to begin the O&M manuals immediately after the approval of submittals by the A/E. These "in-progress" O&M manuals shall be available for inspection on site by the CA. As the manuals near completion, clarify and update the original sequences of operation to as-built conditions.

Contractors shall assist (along with the A/E) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.

Provide limited assistance to the CA in preparing the specific functional performance test procedures as specified in Section 15997. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.

Develop a full start-up and initial checkout plan using manufacturer's start-up procedures and the prefunctional checklists from the CA for all commissioned equipment. Submit to CA for review and approval prior to startup. Refer to Section 15996 for further details on start-up plan preparation.

During the startup and initial checkout process, execute the prefunctional checklists for all commissioned equipment, providing a copy to the CA.

Address current A/E punch list items prior to the start of FPTs. Air and water TAB shall be completed with discrepancies and problems remedied before FPTs of the respective air- or water-related systems (note that the completion of FPTs is a requirement for Substantial Completion).

Execute initial equipment start-up and FPTs in coordination with, and under the direction of the CA. Provide skilled technicians to execute starting of equipment and to execute FPTs. Ensure personnel are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem solving. Assist the CA in interpreting the monitoring data, as necessary.

Correct deficiencies (differences between specified and observed performance) as documented by the CA and A/E and retest the equipment. During construction, maintain as-built red-line drawings for all drawings and final CAD as-builts for contractor-generated coordination drawings. Update after completion of commissioning (excluding deferred testing).

Provide training of the Owner's operating staff using expert qualified personnel, as specified.

Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

Warranty Period:

Execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.

Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

Mechanical Contractor. The responsibilities of the HVAC mechanical contractor, during construction and acceptance phases in addition to those listed in (A) are:

Assist and cooperate with the TAB contractor and CA by:

Putting all HVAC equipment and systems into operation and continuing the operation during each working day of TAB and commissioning, as required.

Supplying sheaves and belts that may be required by TAB and including that cost in the bid price.

Providing test holes in ducts and plenums where directed by TAB to allow air measurements and air balancing. Providing an approved plug.

Providing temperature and pressure taps according to the Construction Documents for TAB and commissioning testing.

Install a P/T plug at each water sensor, which is an input point to the control system.

Prepare a preliminary schedule for Division 15 pipe and duct system testing, flushing and cleaning, equipment start-up and TAB start and completion for use by the CA. Update the schedule as appropriate.

Notify the GC and the CA with duplicate transmittals when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and TAB will occur. Be responsible to notify the GC and CA, ahead of time, when Cx activities not yet performed or not yet scheduled will delay construction. Be proactive in seeing that Cx processes are executed and that the CA has the scheduling information needed to efficiently execute the Cx process.

Controls Contractor. The Cx responsibilities of the controls contractor, during construction and acceptance phases in addition to those listed in (A) are:

Sequences of Operation Submittals. The Controls Contractor's submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the specifications. They shall include:

An overview narrative of the system (1 or 2 paragraphs) generally describing its purpose, components and function.

All interactions and interlocks with other systems.

Detailed delineation of control between any packaged controls and the building automation system, listing what points the BAS

monitors only and what BAS points are control points and are adjustable.

Written sequences of control for packaged controlled equipment. (Equipment manufacturers' stock sequences may be included, but will generally require additional narrative).

Start-up sequences.

Warm-up mode sequences.

Normal operating mode sequences.

Unoccupied mode sequences.

Shutdown sequences.

Capacity control sequences and equipment staging.

Temperature and pressure control: setbacks, setups, resets, etc.

Detailed sequences for all control strategies, e.g., economizer control, optimum start/stop, staging, optimization, demand limiting, etc.

Effects of power or equipment failure with all standby component functions.

Sequences for all alarms and emergency shut downs.

Seasonal operational differences and recommendations.

Initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.

Schedules, as specified or, if not specified, as-installed.

To facilitate referencing in testing procedures, all sequences shall be written in small statements, each with a number for reference. For a given system, numbers will not repeat for different sequence sections, unless the sections are numbered.

Control Drawings Submittal:

The control drawings shall have a key to all abbreviations.

The control drawings shall contain graphic schematic depictions of the systems and each component.

The schematics will include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.

Provide a full points list with at least the following included for each point:

- 1) Controlled system.
- 2) Point abbreviation.
- 3) Point description.
- 4) Display unit.
- 5) Control point or setpoint.
- 6) Monitoring point.

Key:

Point Description: DB temp, airflow, etc.

Control or Setpoint: Point that controls equipment and can have its setpoint changed (OSA, SAT, etc.)

Monitoring Point: Point that does not control or contribute to the control of equipment, but is used for operation, maintenance, or

performance verification.

The Controls Contractor shall keep the CA informed of all changes to this list during programming and setup.

An updated as-built version of the control drawings and sequences of operation shall be included in the final controls O&M manual submittal.

Assist and cooperate with the TAB contractor in the following manner:

Meet with the TAB contractor prior to beginning TAB and review the TAB plan to determine the capabilities of the control system toward completing TAB. Provide the TAB any needed unique instruments for setting terminal unit boxes and instruct TAB in their use (handheld control system interface for use around the building during TAB, etc.).

For a given area, complete all required prefunctional checklists, calibrations, startup and selected functional tests of the system and have them approved by the CA prior to TAB.

Provide a qualified technician to operate the controls to assist the TAB contractor in performing TAB, or provide sufficient training for TAB to operate the system without assistance.

Assist and cooperate with the CA in the following manner:

Using a skilled technician who is familiar with this building, execute the controls system FPTs as specified for the controls contractor in Section 15997. Assist in the functional testing of all equipment specified in Section 15997.

Execute all control system trend logs specified in Section 15997.

The controls contractor shall prepare a written plan indicating in a step-by-step manner, the procedures that will be followed to test, checkout and adjust the control system prior to FPTs, according to the process in Section 15996. At minimum, the plan shall include for each type of equipment controlled by the automatic controls:

System name.

List of devices.

Step-by-step procedures for testing each controller after installation, including:

- 1) Process of verifying proper hardware and wiring installation.
- 2) Process of downloading programs to local controllers and verifying that they are addressed correctly.
- 3) Process of performing operational checks of each controlled component.
- 4) Plan and process for calibrating valve and damper actuators and all sensors.
- 5) A description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.

A copy of the log and field checkout sheets that will document the process. This log must include a place for initial and final read values during calibration of each point and clearly indicate when

a sensor or controller has "passed" and is operating within the contract parameters.

A description of the instrumentation required for testing.

Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the CA and TAB contractor for this determination.

Provide a signed and dated certification to the CA upon completion of the checkout of each controlled device, equipment and system prior to functional testing for each piece of equipment or system, that all system programming is complete as to all respects of the Contract Documents, except functional testing requirements. Beyond the control points necessary to execute all documented control sequences, provide monitoring, control and virtual points as specified. List and clearly identify, on the as-built, duct and piping drawings the locations of all static and differential pressure sensors (air, water and building pressure).

TAB Contractor. The duties of the TAB contractor, in addition to those listed in (A) are:

Submit the outline of the TAB plan and approach for each system and component to the CA, and the controls contractor six weeks prior to starting the TAB. This plan will be developed after the TAB has some familiarity with the control system.

The submitted plan will include:

Certification that the TAB contractor has reviewed the construction documents and the systems with the design engineers and contractors to sufficiently understand the design intent for each system.

An explanation of the intended use of the building control system.

The controls contractor will comment on feasibility of the plan. All field checkout sheets and logs to be used that list each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.

Discussion of what notations and markings will be made on the duct and piping drawings during the process.

Final test report forms to be used.

Detailed step-by-step procedures for TAB work for each system and issue: terminal flow calibration (for each terminal type), diffuser proportioning, branch / submain proportioning, total flow calculations, rechecking, diversity issues, expected problems and solutions, etc. Criteria for using air flow straighteners or relocating flow stations and sensors will be discussed. Provide the analogous explanations for the water side.

List of all airflow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.

Details of how total flow will be determined (Air: sum of terminal flows via BAS calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations. Water: pump curves, circuit setter, flow station, ultrasonic, etc.).

The identification and types of measurement instruments to be used and their most recent calibration date.

Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and provide methods to verify this.

Confirmation that TAB understands the outside air ventilation criteria under all conditions.

Details of whether and how minimum outside air cfm will be verified and set, and for what level (total building, zone, etc.).

Details of how building static and exhaust fan / relief damper capacity will be checked.

Details of methods for making any specified coil or other system plant capacity measurements.

Details of any TAB work to be done in phases (by floor, etc.), or of areas to be built out later.

Details regarding specified deferred or seasonal TAB work.

Details of any specified false loading of systems to complete TAB work.

Details of all exhaust fan balancing and capacity verifications, including any required room pressure differentials.

A running log of events and issues shall be kept by the TAB field technicians. Submit hand-written reports of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests to the CA.

Provide a draft TAB report within two weeks of completion. A copy will be provided to the CA. The report will contain a full explanation of the methodology, assumptions and the results in a clear format with designations of all uncommon abbreviations and column headings. The report should follow the latest and most rigorous reporting recommendations by AABC, NEBB or ASHRAE Standard 111.

Provide the CA with any requested data, gathered, but not shown on the draft reports.

Provide a final TAB report for the CA with details, as in the draft.

Mechanical Designer. Refer to Section 15996 for the responsibilities of the mechanical designer.

1.3 RELATED WORK

Refer to Section 15997 for systems to be commissioned and for functional testing requirements.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

Division 15 shall provide all test equipment necessary to fulfill the testing requirements of this Division.

Refer to Section 15996 Part 2.1 for additional test equipment requirements.

PART 3 EXECUTION

3.1 SUBMITTALS

Division 15 shall provide submittal documentation relative to Cx as required in this Section Part 1, Section 01300 and Section 15996.

3.2 STARTUP

The HVAC mechanical and controls contractors shall follow the start-up and initial checkout procedures listed in the Responsibilities list in this section and in 15996. Division 15 has start-up responsibility and is required to complete systems and sub-systems so they are fully functional, meeting the design objectives of the Contract Documents. The Cx procedures and FPTs do not relieve or lessen this responsibility or shift responsibility in any way to the CA or Owner.

FPTs shall begin upon completion of a system. FPTs may proceed prior to the completion of systems or sub-systems at the discretion of the CA. Beginning FPTs before full completion does not relieve the Contractor of the responsibility of fully completing the system, including all prefunctional checklists, as soon as possible.

3.3 TAB

Refer to the TAB responsibilities in Part 1.2 above.

3.4 FUNCTIONAL PERFORMANCE TESTS (FPTs)

Refer to Section 15996 Part 3.5 for general details and to Section 15997 for specific details on required FPTs.

3.5 TESTING DOCUMENTATION, NON-CONFORMANCE AND APPROVALS

Refer to Section 15996 Part 3.4 for specific details on non-conformance issues relating to prefunctional checklists and tests..

3.6 OPERATION AND MAINTENANCE (O&M) MANUALS

The following O&M manual requirements do not replace O&M manual documentation requirements elsewhere in these specifications.

Division 15 shall compile and prepare documentation for all equipment and systems covered in Division 15 and deliver this documentation to the GC for inclusion in the O&M manuals prior to the training of owner personnel. Note that O&M manuals and training are required parts of the Cx process and the completion of the Cx process is required for the granting of Substantial Completion.

The CA shall receive a "first draft" copy of the O&M manuals for review within 30 days of the arrival of the last piece of equipment on the construction site. The CA will review the manuals for completeness and adequacy for training the facility O&M staff.

Special Control System O&M Manual Requirements. In addition to documentation that may be specified elsewhere, the controls contractor

shall compile and organize at minimum the following data on the control system in labeled 3-ring binders with indexed tabs.

Three copies of the controls training manuals in a separate manual from the O&M manuals.

Operation and Maintenance Manuals containing:

Specific instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. These instructions shall be step-by-step. Indexes and clear tables of contents shall be included. The detailed technical manual for programming and customizing control loops and algorithms shall be included.

Full as-built set of control drawings (refer to Submittal section above for details).

Full as-built sequence of operations for each piece of equipment. Full points list. In addition to the updated points list required in the original submittals (Part 1 of this section), a listing of all rooms shall be provided with the following information for each room:

- 1) Floor
- 2) Room number
- 3) Room name
- 4) Air handler unit ID
- 5) Reference drawing number
- 6) Air terminal unit tag ID
- 7) Heating and/or cooling valve tag ID
- 8) Minimum cfm
- 9) Maximum cfm

Full print out of all schedules and set points after testing and acceptance of the system.

Full as-built print out of software program.

Electronic copy on disk of the entire program for this facility.

Marking of all system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.

Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.

Control equipment component submittals, parts lists, etc.

Warranty requirements.

Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).

The manual shall be organized and subdivided with permanently labeled tabs for each of the following data in the given order:

Sequences of operation.

Control drawings.

Points lists.

Controller / module data.

Thermostats and timers.

- Sensors and DP switches.
- Valves and valve actuators.
- Dampers and damper actuators.
- Program setups (software program printouts).

Field checkout sheets and trend logs should be provided to the CA for inclusion in the final Commissioning Report.

Special TAB Documentation Requirements. The TAB will compile and submit the following with other documentation that may be specified elsewhere in the Specifications.

Final report containing an explanation of the methodology, assumptions, test conditions and the results in a clear format with designations of all uncommon abbreviations and column headings.
The TAB shall mark on the drawings where all traverse and other critical measurements were taken and cross reference the location in the TAB report.

3.7 TRAINING OF OWNER PERSONNEL

The GC shall be responsible for training the facility O&M staff and for coordinating and scheduling with the CA for the monitoring and verification of that training. Note that training is a requirement for the completion of commissioning, which is a requirement for Substantial Completion. Refer to Section 15996 for additional details.

The CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment. Refer to Section 15996 for additional details.

Mechanical Contractor. The mechanical contractor shall have the following training responsibilities:

Provide the CA with a training plan two weeks before the planned training according to the outline described in Section 15996, Part 3.8. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of HVAC equipment including, but not limited to, pumps, air handling units, fans, chillers, boilers, controls and water treatment systems, etc.

Training shall normally start with classroom sessions followed by hands-on training on each piece of equipment, which shall illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.

During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.

The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of all modes of

operation of the specific piece of equipment are required. More than one party may be required to execute the training.

The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.

Training shall include:

- Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.

- A review of the written O&M instructions, as included in the O&M manuals, emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shutdown, seasonal changeover and any emergency procedures.

- Discussion of relevant health and safety issues and concerns.

- Discussion of warranties and guarantees.

- Common troubleshooting problems and solutions.

- Explanatory information included in the O&M manuals and the location of all plans and manuals in the facility.

- Discussion of any peculiarities of equipment installation or operation.

- Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.

Hands-on training shall include start-up, operation in all modes possible, including manual, shutdown and any emergency procedures and preventative maintenance for all pieces of equipment.

The mechanical contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not controlled by the central control system.

Training shall occur after FPTs are complete, unless approved otherwise by the CA and CM.

Controls Contractor. The controls contractor shall have the following training responsibilities:

- Provide the GC and CA with a training plan four weeks before the planned training according to the outline described in Section 15996, Part 3.8.

- The controls contractor shall provide designated Owner personnel training on the control system in this facility. The intent is to clearly and completely instruct the Owner on all the capabilities of the control system.

- Training manuals. The standard operating manual for the system and any special training manuals will be provided for each trainee, with three extra copies left for the O&M manuals. In addition, copies of the system technical manual will be demonstrated during training and three copies submitted with the O&M manuals. Manuals shall include detailed description of the subject matter for each session. The manuals will cover all control sequences and have a definitions section that fully

describes all relevant words used in the manuals and in all software displays.

The trainings will be tailored to the needs and skill-level of the trainees.

The trainers will be knowledgeable on the system and its use in buildings. For the on-site sessions, the most qualified trainer(s) will be used.

During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.

The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

The Training Session shall consist of the following areas:

Training I. Control System. Upon completion, each student, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.

Training II. Building Systems. The session shall include instruction on:

- 1) Specific hardware configuration of installed systems in this building and specific instruction for operating the installed system, including HVAC systems, and any interface with special systems.

- 2) Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.

- 3) All trending and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends. Trainees will actually set-up trends in the presence of the trainer.

- 4) Every screen shall be completely discussed, allowing time for questions.

- 5) Use of keypad or plug-in laptop computer at the zone level.

Training III. The session will be structured to address specific topics that trainees need to discuss and to answer questions concerning operation of the system.

3.8 DEFERRED TESTING

Refer to Section 15996, Part 3.9 for requirements of deferred testing.

3.9 WRITTEN WORK PRODUCTS

Written work products of Contractors will consist of the start-up and initial checkout plan described in Section 15996 and the filled out start-up, initial checkout and prefunctional checklists.

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15996

COMMISSIONING - GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 DESCRIPTION

Commissioning: Commissioning (Cx) is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. This is achieved by beginning in the design phase and documenting design intent and continuing through construction, acceptance and the warranty period with actual verification of performance. The Cx process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.

Cx during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:

- Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.

- Verify and document proper performance of equipment and systems.

- Verify that O&M documentation left on site is complete.

- Verify that the Owner's operating personnel are adequately trained.

Cx does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

Abbreviations: The following are common abbreviations used in the Specifications and in the Commissioning Plan. Definitions are found in Section 1.5.

- A/E: Architect and Design Engineers.

- CA: Commissioning Authority.

- CC: Controls Contractor.

- CM: Construction Manager.

- Cx: Commissioning.

- Cx Plan: Commissioning Plan Document.

- EC: Electrical Contractor.

- FPT: Functional Performance Test.

- GC: General Contractor.

- MC: Mechanical Contractor.

- PC: Prefunctional checklist.

- Subs: Subcontractors to General.

- TAB: Test and Balance Contractor.

1.2 COORDINATION

Cx Team: The members of the Cx team consist of the Commissioning Authority (CA), the representative Construction Manager (CM), the General Contractor (GC), the Architect and design engineers (particularly the mechanical engineer), the Mechanical Contractor (MC), the Electrical Contractor (EC), the TAB representative, the Controls Contractor (CC), any other installing subcontractors or suppliers of equipment.

Management. The CA is hired by the Owner directly. The CA directs and coordinates the Cx activities. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.

Scheduling: The CA will work with the CM and GC according to established protocols to schedule the Cx activities. The CA will provide sufficient notice to the CM and GC for scheduling commissioning activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

The CA will provide the initial schedule of primary commissioning events at the commissioning scoping meeting. The Commissioning Plan-Construction Phase provides a format for this schedule. As construction progresses, more detailed schedules are developed by the CA. The Commissioning Plan also provides a format for detailed schedules.

1.3 COMMISSIONING PROCESS

Commissioning Plan: The commissioning plan provides guidance in the execution of the commissioning process. Just after the initial commissioning scoping meeting the CA will update the plan which is then considered the "final" plan, though it will continue to evolve and expand as the Project progresses. The Specifications will take precedence over the Commissioning Plan.

Commissioning Process: The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.

Commissioning during construction begins with a scoping meeting conducted by the CA where the commissioning process is reviewed with the commissioning team members. Additional meetings will be required throughout construction, scheduled by the CA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems. Equipment documentation is submitted to the CA during normal submittals, including detailed start-up procedures. The CA works with the Subs in developing startup plans and startup documentation formats, including providing the Subs with prefunctional checklists to be completed, during the startup process. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with prefunctional checklists being completed before

functional testing.

The Subs, under their own direction, execute and document the prefunctional checklists and perform startup and initial checkout. The CA documents that the checklists and startup were completed according to the approved plans.

This may include the CA witnessing start-up of selected equipment.

The CA develops specific equipment and system functional performance test procedures. The Subs review the procedures.

The procedures are executed by the Subs, under the direction of, and documented by the CA.

Items of non-compliance in material, installation or setup are corrected at the Sub's expense and the system retested.

The CA reviews the O&M documentation for completeness.

Commissioning is completed before Substantial Completion.

The CA reviews, pre-approves and coordinates the training provided by the Subs and verifies that it was completed.

Deferred testing is conducted, as specified or required.

Additional Commissioning: The following narrative provides a brief overview of the additional commissioning tasks performed by and independent third party outside of the design firm.

Review of the construction documents confirming whether the design will or will not meet the owner's goals for the building systems.

Review the construction documents for adequate commissioning requirements.

Review contractor submittals for commissioned systems and equipment.

Create a recommissioning management manual to include the LEED reference guide. The manual should also include sequences of operation for all equipment, descriptions of energy and water saving features, seasonal startup and shutdown procedures, a list of diagnostic tools, etc. The manual is intended to provide the owner with in-depth tools and strategies for keeping the building running in optimal condition.

1.4 RESPONSIBILITIES

The responsibilities of various parties in the commissioning process are provided in this section. The responsibilities of the Mechanical Contractor, TAB and Controls Contractor are in Division 15 and those of the Electrical Contractor in Division 16.

All Parties:

Attend commissioning scoping meeting and additional meetings, as necessary.

Mechanical and Electrical Designers/Engineers (of the A/E):

Construction and Acceptance Phase:

Perform normal submittal review, construction observation, As-Built Drawing preparation, etc., as contracted. One site observation should be completed just prior to system startup.

Provide any design narrative and sequences documentation requested

by the CA. The designers shall assist (along with the Contractors) in clarifying the operation and control of commissioned equipment in areas where the Specifications, Control Drawings or equipment documentation is not sufficient for writing detailed testing procedures.

Attend commissioning scoping meetings and other selected commissioning team meetings.

Participate in the resolution of system deficiencies identified during commissioning, according to the Contract Documents.

Prepare and submit the final as-built design intent and operating parameters documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.

From the Contractor's red-line Drawings, edit and update one-line diagrams developed as part of the design narrative documentation and those provided by the vendor as Shop Drawings for the chilled and hot water, supply, return and exhaust air systems.

Provide a presentation at one of the training sessions for the Owner's personnel.

Warranty Period: Participate in the resolution of non-compliance, non-conformance and design deficiencies identified during commissioning during warranty-period commissioning.

Commissioning Authority (CA):

The CA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CA may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the General Contractor and the design team.

The primary role of the CA is to develop and coordinate the execution of a testing plan, observe and document performance, and confirm that systems are functioning in accordance with the design intent and in accordance with the Contract Documents. The Contractors will provide all tools or the use of tools to start, checkout and functionally test equipment and systems.

Construction and Acceptance Phase:

Coordinates and directs the Cx activities using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all parties, frequently updated timelines and schedules and technical expertise.

Coordinate the Cx work with the GC, ensure that commissioning activities are being scheduled into the master schedule.

Revise, as necessary, Commissioning Plan-Construction Phase.

Plan and conduct a commissioning scoping meeting and other commissioning meetings.

Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.

Before startup, gather and review the current control sequences and interlocks and work with Contractors and Design Engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.

Review and approve normal Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.

Write and distribute prefunctional tests and checklists.

Develop assist in the development of start-up and initial systems checkout plans with Subs.

Perform site visits to observe installations. Attend selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for changes relating to the Cx process. Assist in resolving any discrepancies.

Witness random parts of the HVAC piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in final report.

Witness random parts of any ductwork testing and cleaning procedures, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in final report.

Approve prefunctional tests and checklist completion by reviewing prefunctional checklist reports and by selected site observation and spot-checking.

Approve systems startup by reviewing start-up reports and by selected site observation.

Review TAB execution plan.

Oversee control system FPTs and approve it to be used for TAB, before TAB is executed.

Approve air and water systems balancing by spot testing, by reviewing completed reports and by selected site observation.

With necessary assistance and review from installing contractors, write the functional performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing.

Analyze any functional performance trend logs and monitoring data to verify performance.

Coordinate, witness and approve manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.

Maintain a master deficiency and resolution log and a separate testing record.

Witness performance testing of smoke control systems by others and all other owner contracted tests or tests by manufacturer's personnel over which the CA may not have direct control. Document these tests and include this documentation in the final Cx report.

Review equipment warranties to ensure that the Owner's responsibilities are clearly defined.

Oversee and approve the training of the Owner's O&M staff.

Compile and maintain a commissioning record and building systems book(s).

Review and approve the preparation of the O&M manuals.

Provide a final commissioning report.

Warranty Period:

Coordinate and supervise required seasonal or deferred testing and deficiency corrections.

Return to the site at 10 months into the 12-month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

Construction Manager (CM):

Construction and Acceptance Phase:

With the CA, facilitate the coordination of the Cx work. With the CA and GC, ensure that commissioning activities are being scheduled into the master schedule. Enforce Cx milestones by withholding contractor payments when required.

Review the final Cx Plan-Construction Phase.

Coordinate the scheduling and attend the Cx scoping meeting and other Cx team meetings, as necessary.

Coordinate the normal review of Contractor submittals and furnish a copy of construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CA.

Review the FPT procedures submitted by the CA, prior to testing. When necessary, observe and witness prefunctional checklists, startup and FPTs of selected equipment.

Review commissioning progress and deficiency reports.

Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.

Assist the GC and CA in coordinating the training of owner personnel.

General Contractor (GC):

Construction and Acceptance Phase:

Facilitate the coordination of the commissioning work by the CA, and with the CM and CA ensure that commissioning activities are being scheduled into the master schedule.

Include the cost of commissioning in the total contract price.

Furnish a copy of all Construction Documents, addenda, change orders and approved submittals and Shop Drawings related to commissioned equipment to the CA.

In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.

Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.

A representative shall attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process.

Coordinate the training of owner personnel.

Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

Warranty Period:

Ensure that Subs execute seasonal or deferred functional performance testing, witnessed by the CA, according to the Specifications.

Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and As-Built Drawings for applicable issues identified in any seasonal testing.

Equipment Suppliers (through the GC and Subs):

Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.

Assist in equipment testing per agreements with Subs.

Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor.

Through the Contractors they supply products to, analyze specified products and verify that the designer has specified the newest most updated equipment reasonable for this Project's scope and budget. Provide information requested by CA regarding equipment sequence of operation and testing procedures.

Review test procedures for equipment installed by factory representatives.

1.5 DEFINITIONS

Acceptance Phase: Phase of construction after startup and initial checkout when functional performance tests, O&M documentation review and training occurs.

Approval: Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.

Architect / Engineer (A/E): the prime consultant (Architect) and sub-consultants who comprise the design team, generally the HVAC mechanical designer/engineer and the electrical designer/engineer.

Basis of Design: The basis of design consists of the logic and assumptions behind the design decisions made to meet the design intent. The basis of design describes the systems, components, conditions and methods chosen to meet the intent. Some reiterating of the design intent may be included.

Commissioning Authority (CA): The CA directs and coordinates the day-to-day commissioning activities.

Commissioning Plan: An overall plan, developed before or after bidding that provides the structure, schedule and coordination planning for the commissioning process.

Contract Documents: The documents binding the Owner and GC involved in the construction of this Project (Drawings, Specifications, change orders, amendments, contracts, Cx Plan, etc.).

Control System: The central building energy management control system.

Construction Manager (CM) - the Owner's representative in the day-to-day activities of construction. CM is selected by the Owner to manage the project including: approving pay requests, executing change orders and RFIs and coordinating and enforcing project quality. The GC reports to the CM.

Datalogging: Monitoring flows, currents, status, pressures, etc. of equipment using stand-alone dataloggers separate from the control system.

Deferred FPTs: FPTs that are performed after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow the testing during normal construction.

Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents.

Design Intent: A document that lists the ideas, concepts and criteria of the project that is critical to the owner. It is initially the outcome of the programming and conceptual design phases.

Engineer's Design Narrative: Sections of either the Design Intent or Basis of Design, written by the design engineer, that explain the operation of the equipment and systems in the project.

Factory Testing: Testing of equipment on-site or at the factory, by factory personnel with an Owner's representative present.

Functional Performance Test (FPT): Test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already

been set up. The commissioning authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. FPTs are performed after prefunctional checklists and startup are complete.

General Contractor (GC): The Prime Contractor for this project, with whom the Owner has contracted.

Indirect Indicators: Indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed.

Manual Test: Using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").

Monitoring: The recording of parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of control systems.

Over-written Value: Writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50 deg F to 75 deg F to verify economizer operation). See also "Simulated Signal."

Prefunctional Checklist (PC): A list of items to inspect and elementary component tests to verify proper equipment installation, provided by the CA to the Sub. Prefunctional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels, labels affixed, gages in place, sensors calibrated, etc.). However, some prefunctional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system). The word prefunctional refers to before functional testing. PCs augment and are combined with the manufacturer's start-up checklist. Even without a Cx process, contractors typically perform some, if not many, of the prefunctional checklist items the CA will recommend. However, few contractors document this in writing. The CA only requires that the procedures be documented in writing, and does not witness much of the prefunctional checklisting, except for larger or more critical pieces of equipment.

Sampling: Functionally testing only a fraction of the total number of identical or near identical pieces of equipment.

Simulated Condition: Condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).

Simulated Signal: Disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.

Specifications: The construction Specifications of the Contract Documents.

Startup: The initial starting or activating of dynamic equipment, including executing prefunctional checklists.

Subs: The subcontractors to the GC who provide and install building components and systems.

Test Procedures: The step-by-step, process which must be executed to fulfill the test requirements. The test procedures are developed by the CA.

Test Requirements: Requirements specifying what modes and functions, etc. shall be tested. The test requirements are not the detailed test procedures.

Trending: Monitoring and recording using the building control system.

Vendor: Supplier of equipment.

Warranty Period: Warranty period for entire Project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

1.6 SYSTEMS TO BE COMMISSIONED

The following systems will be commissioned in this Project.

Equipment and System	Functional Test Requirements Specified In:
HVAC System	
Pumps	15997
Piping systems	15997
Ductwork	15997
Variable frequency drives	15997
Air handlers	15997
Make-up Air Unit	15997
Blower Units	15997
VAV Boxes	15997
Exhaust Fans	15997
Testing, Adjusting and Balancing work	15997
HVAC control system	15997

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division Contractor for the equipment being tested. For example, the Mechanical Contractor of Division 15 shall ultimately be responsible for

all standard testing equipment for the HVAC system and controls system in Division 15, except for equipment specific to and used by TAB in their commissioning responsibilities.

Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price and LEFT ON SITE at the project's completion.

All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5 deg F and a resolution of + or - 0.2 deg F. Pressure sensors shall have an accuracy of + or - 5.0 percent of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 EXECUTION

3.1 MEETINGS

Scoping Meeting: The CA will plan and conduct a Cx scoping meeting that will coincide with the pre-construction meeting with the entire Cx team in attendance. Meeting minutes will be distributed to all parties by the CA. Information gathered from this meeting will allow the CA to revise the Cx Plan to its final version, which will also be distributed to all parties.

Miscellaneous Meetings: Other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subs. The CA will plan these meetings and will minimize unnecessary time being spent by Subs.

3.2 REPORTING

The CA will regularly communicate with all members of the commissioning team, through the CM, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.

Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.

A final summary report by the CA will be provided to the CM, focusing on evaluating commissioning process issues. All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report. PCs, FPTs and monitoring reports will be part of the final report.

3.3 SUBMITTALS

The CA will be provided with copies of approved submittal information, required to facilitate the Cx work, through the A/E. This will be integrated into the normal submittal process and protocol of the construction team as defined at the pre-construction meeting. At minimum, this information will include the manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, sequences of operation, O&M data, performance data, any performance test procedures, Control Drawings and details of owner contracted tests. In addition, the installation and checkout materials that are shipped inside the equipment and the field checkout sheet forms to be used by the factory or field technicians shall be submitted to the CA. All documentation requested by the CA will be included by the Subs in their O&M manual contributions which will be ready for preliminary distribution 30 days after the last piece of equipment has arrived on-site.

The CA will review submittals related to the commissioned equipment for adequacy for developing test procedures and for nominal compliance with the contract documents. This review is intended primarily for the development of FPTs and only secondarily to verify compliance with equipment Specifications. The CA will notify the A/E of items missing or incomplete and such short-comings shall be remedied by the contractor.

The CA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

These submittals to the CA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CA will review and approve them. See Division 1 for specific requirements for O&M manuals, including the requirements for preliminary manuals to be complete 30 days after the arrival of the last piece of equipment on site.

3.4 START-UP, PREFUNCTIONAL CHECKLISTS (PCs) AND INITIAL CHECKOUT

The following procedures apply to all equipment to be commissioned.

General: PCs are important to ensure that the equipment and systems are hooked up and operational. They ensure that FPTs (in-depth system checkout) will proceed without delays. Each piece of equipment receives full prefunctional checkout. No sampling strategies are used. The prefunctional testing for a given system must be successfully completed prior to FPTs of equipment or subsystems of the given system. Completion of FPTs is a requirement for completion of commissioning which is a requirement for the granting of Substantial Completion.

Start-up and Initial Checkout Plan: The CA shall assist the Cx team members responsible for startup of any equipment in developing detailed start-up plans for all equipment. The primary role of the CA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed. Parties responsible for PCs and startup are identified in the Cx scoping meeting and in the checklist forms. Parties responsible for executing FPTs are identified in the testing requirements in Section 17000.

The prefunctional checklists indicate required procedures to be executed as part of startup and initial checkout of the systems and the party responsible for their execution.

These checklists and tests are provided by the CA to the GC. The GC determines which trade is responsible for executing and documenting each of the line item tasks and notes that trade on the form. Each form may have more than one trade responsible for its execution. The subcontractor responsible for the purchase of the equipment develops the full start-up plan by combining (or adding to) the CA's checklists with the manufacturer's detailed start-up and checkout procedures from the O&M manual and the normally used field checkout sheets. The plan will include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.

The full start-up plan could consist of something as simple as:

- The CA's prefunctional checklists.

- The manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.

- The manufacturer's normally used field checkout sheets.

The subcontractor submits the full startup plan to the CA for review and approval.

The CA reviews and approves the procedures and the format for documenting them, noting any procedures that need to be added.

Sensor and Actuator Calibration.

All field-installed temperature, pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described below. Alternate methods may be used, if approved by the Owner before-hand. All test instruments shall have had a certified calibration within the last 12 months. Sensors installed in the unit at the factory with calibration certification provided, do not need to be field calibrated.

All procedures used shall be fully documented on the prefunctional checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.

Sensor Calibration Methods:

All Sensors: Verify that all sensor locations are appropriate and away from causes of erratic operation. Verify that sensors with shielded cable are grounded only at one end. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.

Sensors Without Transmitters: Standard Application. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS) is within the tolerances in the table below of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.

Sensors With Transmitters: Standard Application. Disconnect sensor. Connect a signal generator in place of sensor. Connect ammeter in series between transmitter and BAS control panel. Using manufacturer's resistance-temperature data, simulate minimum desired temperature. Adjust transmitter potentiometer zero until 4mA is read by the ammeter.

Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the BAS. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship reset, reset relationship and P/I reaction. Reconnect sensor. Make reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS) is within the tolerances in the table below of the instrument-measured value. If not, replace sensor and repeat. For pressure sensors, perform a similar process with a suitable signal generator.

Tolerances, Standard Applications

Sensor	Required Tolerance (+/-)	Sensor	Required Tolerance (+/-)
Hot water temp	1.5F		
Outside air, space air, duct air temps	0.5F		
Pressures, air, water and gas	3% of design		
Flow rates, air	10% of design		

Valve and Damper Stroke Setup and Check:

EMS Readout: For all valve and damper actuator positions checked, verify the actual position against the BAS readout.

Set pumps or fans to normal non-operating mode. Command valve or damper closed, visually verify that valve or damper is closed and adjust output zero signal as required. Command valve or damper open, verify position is full open and adjust output signal as required. Command valve or damper to a few intermediate positions. If actual valve or damper position doesn't reasonably correspond, replace actuator.

Execution of Prefunctional Checklists (PCs) and Startup:

Several weeks prior to startup, the Subs and vendors schedule startup and checkout with the GC, CM and CA. The performance of the PCs, startup and checkout are directed and executed by the Sub or vendor. When checking off PCs, signatures may be required of other Subs for verification of completion of their work.

The CA shall observe, at minimum, the procedures for each piece of primary equipment, unless there are multiple units, (in which case a

sampling strategy may be used). In no case will the number of units witnessed be less than 20% of the total number of identical or very similar units.

For lower-level components or equipment, (e.g., VAV boxes, sensors, controllers), the CA shall observe a sampling of the prefunctional and start-up procedures. The sampling procedures will be identified in the commissioning plan.

The Subs and vendors shall execute startup and provide the CA with a signed and dated copy of the completed start-up and prefunctional tests and checklists.

Only individuals that have direct knowledge and have witnessed that a PC task was performed shall initial or check that item off.

Deficiencies, Non-Conformance and Approval in Checklists and Startup:

The Subs shall clearly list any outstanding items of the initial start-up and prefunctional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CA within two days of test completion.

The CA shall work with the Subs and vendors to correct and retest deficiencies or uncompleted items. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CA as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original non-compliance report.

Items left incomplete, which later cause deficiencies or delays during functional testing may result in backcharges to the responsible party. Refer to Part 3.6 herein for details.

3.5 FUNCTIONAL PERFORMANCE TESTS (FPTs)

This sub-section applies to all commissioning functional testing for all divisions.

The general list of equipment to be commissioned is found in Section 17000, Part 1.6.

The parties responsible to execute each test are listed with each test in Sections 17000.

Objectives and Scope. The objective of FPTs is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze

condition, no flow, equipment failure, etc. shall also be tested.

Development of Test Procedures: Before test procedures are written, the CA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements in Sections 17000, the CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each Sub or vendor responsible to execute a test, shall provide limited assistance to the CA in developing the procedures review (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CA shall provide a copy of the test procedures to the Sub(s) who shall review the tests for feasibility, safety, equipment and warranty protection.

The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.

The FPT forms developed by the CA will include (but not be limited to) the following information:

- System and equipment or component name(s).
- Equipment location and ID number.
- Unique test ID number, and reference to unique prefunctional checklist and a start-up documentation ID numbers for the piece of equipment.
- Date.
- Project name.
- Participating parties.
- A copy of the specification section describing the test requirements.
- A copy of the specific sequence of operations or other specified parameters being verified.
- Formulas used in any calculations.
- Required pre-test field measurements.
- Instructions for setting up the test.
- Special cautions, alarm limits, etc.
- Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format.
- Acceptance criteria of proper performance with a Yes/No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
- A section for comments.
- Signatures and date block for the CA.

Test Methods:

Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities. The CA may substitute specified methods or require an additional method to be executed, other than what was specified. The CA will determine which method is most appropriate for tests that do not have a method

specified.

Simulated Conditions. Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.

Overwritten Values. Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable.

Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.

Simulated Signals. Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.

Altering Setpoints. Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55 deg F, when the outside air temperature is above 55 deg F, temporarily change the lockout setpoint to be 2F above the current outside air temperature.

Indirect Indicators. Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the test parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during prefunctional testing.

Setup. Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Sub executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.

Sampling. Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in prefunctional checklist execution.

A common sampling strategy referenced as the "xx% Sampling-yy% Failure Rule" is defined by the following example.

xx = the percent of the group of identical equipment to be included in each sample.

yy = the percent of the sample that if failing, will require another sample to be tested.

The example below describes a 20% Sampling-10% Failure Rule.

Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the "first sample."

If 10% (yy) of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample).

If 10% of the units in the second sample fail, test all remaining units in the whole group.

If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

Coordination and Scheduling: The Subs shall provide sufficient notice to the CA regarding their completion schedule for the prefunctional checklists and startup of all equipment and systems. The CA will schedule FPTs through the GC and affected Subs. The CA shall direct, witness and document the functional testing of all equipment and systems. The Subs shall execute the tests.

In general, functional testing is conducted after prefunctional testing and startup has been satisfactorily completed. The control system is sufficiently tested and approved by the CA before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

Test Equipment. Refer to Section 17000, Part 2 for test equipment requirements.

Problem Solving: The CA will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the GC, Subs and A/E.

3.6 DOCUMENTATION AND NON-CONFORMANCE OF TESTS

Documentation: The CA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose.

Non-Conformance:

The CA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted.

Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form.

Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues.

As tests progress and a deficiency is identified, the CA discusses the issue with the executing contractor.

When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:

- 1) The CA documents the deficiency and the Sub's response and intentions and they go on to another test or sequence. The CA submits the non-compliance reports to the CM. A copy is provided to the Sub. The Sub corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be retested and sends it back to the CA.
- 2) The CA reschedules the test and the test is repeated.

If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:

- 1) The deficiency shall be documented on the non-compliance form with the Sub's response and a copy given to the A/E and to the Sub representative assumed to be responsible.
- 2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Construction Manager.
- 3) The CA documents the resolution process.
- 4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CA. The CA reschedules the test and the test is repeated until satisfactory performance is achieved.

Cost of Retesting:

The cost for the Sub to retest a prefunctional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the GC.

For a deficiency identified, not related to any prefunctional checklist or start-up fault, the following shall apply: The CA will direct the retesting of the equipment once at no "charge" for their time. However, the CA's time for a second retest will be charged to the Owner, who will recover the costs from the GC, who may, in turn, recover the costs from the responsible Sub.

The time for the CA to direct any retesting required because a specific prefunctional checklist or start-up test item, reported

to have been successfully completed, but determined during functional testing to be faulty, will be charged to the Owner, who will recover the costs from the GC, who may, in turn, recover the costs from the responsible Sub.

The Contractor shall respond in writing to the CA at least as often as Cx meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.

The CA retains the original non-conformance forms until the end of the Project.

Any required retesting by any Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the prime Contractor.

Failure Due to Manufacturer Defect. If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the CM. In such case, the Contractor shall provide the Owner with the following:

Within one week of notification from the CM, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the CM within two weeks of the original notice.

Within two weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.

The CM will determine whether a replacement of all identical units or a repair is acceptable.

Two examples of the proposed solution will be installed by the Contractor and the CM will be allowed to test the installations for up to one week, upon which the CM will decide whether to accept the solution.

Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

Approval. The CA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CA and by the CM, if necessary.

3.7 OPERATION AND MAINTENANCE MANUALS

O&M Manuals:

CA Review and Approval: Prior to training (well before Substantial Completion), the CA shall review the O&M manuals, documentation and as-built systems that were commissioned to verify compliance with the Specifications. The CA will communicate deficiencies in the manuals to the CM. The CA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This Work does not supersede the A/E's review of the O&M manuals according to the A/E's contract. Successful completion of the O&M manuals is a prerequisite for training and for the granting of Substantial Completion.

Cx Records:

Final Report Details: The final Cx report will include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the commissioning authority regarding the adequacy of the equipment, documentation and training meeting the Contract Documents in the following areas: 1) Equipment meeting the equipment Specifications, 2) Equipment installation, 3) Functional performance and efficiency, and 4) Operator training. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall also be listed. Each non-compliance issue shall be referenced to the specific functional test, inspection, trend log, etc. where the deficiency is documented. The functional performance and efficiency section for each piece of equipment shall include a brief description of the verification method used (manual testing, BAS trend logs, data loggers, etc.) and include observations and conclusions from the testing.

Other documentation will be retained by the CA.

3.8 TRAINING OF OWNER PERSONNEL

The GC shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed. Completion of training is a requirement for the granting of Substantial Completion. Note that completed and approved O&M manuals are the manuals used for training and that training can't begin until those manuals are completed.

The CA shall be responsible for overseeing and approving the content and adequacy of the training of the Owner personnel for commissioned equipment.

The Owner and CA shall decide how rigorous the training should be for each piece of commissioned equipment. The CA shall communicate the results to the Subs and Vendors who have training responsibilities. The specific training requirements of Owner personnel by Subs and vendors is specified in Division 15 and 16.

Each Sub and vendor responsible for training will submit a written training plan to the CA for review and approval prior to training. The plan will cover the following elements:

Equipment (included in training).
Intended audience.
Location of training.
Objectives.
Subjects covered (description, duration of discussion, special methods, etc.).
Duration of each subject.
Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)

For the primary HVAC equipment, the Control Contractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.

The CA develops an overall training plan and coordinates and schedules, with the GC, the overall training for the commissioned systems. The CA develops criteria for determining that the training was satisfactorily completed, including attending some of the training, etc.

Video-taping of the training sessions will be provided by the CA.

The mechanical design engineer shall at the first training session present the overall system design concept and the design concept of each equipment section. This presentation shall include a review of all systems using the simplified system schematics (one-line Drawings) including chilled water systems, heating systems, supply air systems, exhaust system and outside air strategies.

3.9 DEFERRED TESTING

Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the CM. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

Seasonal Testing: During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) shall be completed as part of this contract. The CA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate Subs, with the CA witnessing. Any final adjustments to the O&M manuals and as-builds due to the testing will be made by the necessary Subs.

3.10 WRITTEN WORK PRODUCTS

The commissioning process generates a number of written work products described in various parts of the Specifications. The Commissioning Plan-Construction Phase, lists all the formal written work products, describes briefly their contents, who is responsible to create them, their due dates, who receives and approves them and the location of the Specification to create them. In summary, the written products are:

	Product	Developed By
1.	Final commissioning plan	CA
2.	Meeting minutes	CA

3.	Commissioning schedules	CA with GC
4.	Overall Construction schedule	GC
5.	Equipment documentation submittals	Subs
6.	Sequence clarifications	Subs and A/E as needed
7.	Prefunctional checklists	CA (completed by subs, approved by CA)
8.	Startup and initial checkout plan (compilation of existing documents)	Subs (With CA assistance)
9.	Startup and initial checkout forms filled out	Subs
10.	Final TAB report	TAB
11.	Commissioning Progress Record	CA
12.	Deficiency reports	CA
13.	Functional test forms	CA
14.	Filled out functional tests	CA
15.	O&M manuals	Subs (approved by A/E and CA)
16.	Commissioning record book	CA
17.	Overall training plan	GC and Subs
18.	Specific training agendas	Subs
19.	Final commissioning report	CA
20.	Recommissioning Managemant Manual	Independent 3rd Party

-- End of Section --

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15997

MECHANICAL FUNCTIONAL PERFORMANCE TESTING REQUIREMENTS

PART 1 GENERAL

1.1 SYSTEMS AND EQUIPMENT INCLUDED IN COMMISSIONING

The following is a list of the equipment and systems for which FPT requirements are included in this section:

- Air handler system
- Make-up Air Handling Unit
- Blower Coil Units
- Hot Water System
- VAV boxes
- Building automation system
- Test and balance (TAB) work

1.2 DESCRIPTION

This section specifies the FPT requirements for Division 15 systems and equipment. From these requirements, the CA shall develop step-by-step procedures to be executed by the Subs and witnessed by the CA. The general FPT process, requirements and test method definitions are described in Section 17000. The test requirements for each piece of equipment or system contain the following:

- The contractors responsible to execute the tests, under the direction of the CA.
- A list of the integral components being tested.
- Prefunctional checklists associated with the components.
- Functions and modes to be tested.
- Required conditions of the test for each mode.
- Special procedures.
- Required methods of testing.
- Required monitoring.
- Acceptance criteria.
- Sampling strategies allowed.

The approved completion of FPTs and commissioning is a requirement for Substantial Completion

1.3 PREREQUISITES

The completion of the following items is required prior to the start of the FPTs.

- Prefunctional checklists have been completed and submitted by the Contractor and approved by the CA. All related equipment has been started up and start-up reports have been submitted to, and approved by the CA.

All control system functions for the tested system and all interlocking systems are programmed and operable per contract documents, including final setpoints and schedules with debugging, loop tuning and sensor calibrations completed.

Piping system flushing is complete and the required reports submitted and approved.

Water treatment system complete and operational and required checklists submitted and approved.

Test and balance (TAB) complete and approved for the hydronic system.

All A/E punchlist items for this equipment and related equipment corrected.

Safeties and operating ranges reviewed by the CA.

False loading equipment, system and procedures ready.

1.4 MONITORING

Monitoring is a method of testing as a stand-alone method or to augment manual testing.

All points listed in the required monitoring section of the test requirements which are control system monitored points shall be trended by the controls contractor. At the CA's request, the controls contractor shall trend up to 20% more points than listed herein at no extra charge.

Hard copies of monitored data must be in columnar format with time down the left column and at least 5 columns of point values on the same page.

Graphical output is desirable, and will be required for all output, if the system can produce it.

PART 2 EXECUTION

2.1 AIR HANDLER UNITS (AHU)

Parties Responsible to Execute Functional Test:

Controls Contractor: Operate the controls to activate the equipment as needed.

HVAC Mechanical Contractor or Vendor: Assist in testing sequences.

CA: Witness, direct and document testing.

Integral Components or Related Equipment Being Tested:

AHU and components (fan, coils, valves, ducts).

Variable Frequency Drive.

Prerequisites: The applicable prerequisite checklist items listed in the beginning of Section 15997 Part 1.3 shall be completed prior to functional testing. The CA will also spot-check miscellaneous items and calibrations on the prefunctional checklists previously completed by the installer, before the beginning of FPTs.

Functions / Modes Required To Be Tested, Test Methods and Seasonal Test Requirements: The following testing requirements are an addition to and do

not replace any testing requirements elsewhere in this Division.

Function / Mode	Test Method Manual, Monitoring, Either or Both	Required Seasonal Test
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General

1. Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, unoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks with which it is associated.

Both

In addition to, or as part of (1) above, the following modes or tests are required:

2. Mixed & supply air, & reset temperature control functions.

Both

Both

3. Economizer functions.

Both

Cooling

4. CO2 monitoring

Both

5. No DX cooling when there is HCV flow.

Both

6. HCV modulation & positive shutoff (no leak-thru).

Manual

7. Damper interlocks and correct modulation in all modes, including smoke and fire dampers.

Manual

8. Temperature difference across HC & CC per specifications.

Manual

9. Heating coil freeze protection.

Manual

10. All alarms (low limits, high temperature, etc.).

Manual

11. Sensor and actuator calibration checks: Duct static pressure sensor, SAT, MAT, OSAT, OSA & RA damper position, valve positions, SF cfm reading with TAB, and other random checks (EMS readout against hand-held calibrated instrument or observation must be within specified tolerances).

Manual

12. Verify schedules and set points to be reasonable and appropriate

Cooling season, Heating season or Both. A blank cell denotes no special seasonal test is required and that test can be executed during any season, if condition simulation is appropriate.

Seasonal test not required if seasonal conditions can be adequately

simulated.

Required Monitoring:

All points listed below, which are control system monitored points shall be trended by the controls contractor. Additional points may be added during functional testing. Refer to the Monitoring section at Section 15997.1.4 for additional monitoring details.

Point	Time Step (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)
For each AHU being tested:				
RAT	10	48 hours	Y	Y
SAT	10	48 hours	Y	Y
HC valve position	10	48 hours	Y	Y
MAT	10	48 hours	Y	Y
VFD Output & Setpt	10	48 hours	Y	Y
OSAT	10	48 hours	Y	Y
Discharge Air Static Pressure	10	48 hours	Y	Y

Acceptance Criteria:

For the conditions, sequences and modes tested, the AHU, integral components and related equipment respond to varying loads and changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

AHU with supporting systems shall be able to maintain the SA temperature within 1.00F either side of the deadband of the current setpoint without excessive hunting.

END OF REQUIREMENTS FOR AHU TEST

2.2 MAKE-UP AIR HANDLING UNITS

Parties Responsible to Execute Functional Test:

Controls Contractor: Operate the controls to activate the equipment as needed.

HVAC Mechanical Contractor or Vendor: Assist in testing sequence.

CA: Witness, direct and document testing.

Integral Components or Related Equipment Being Tested:

AHU and components (fans, coils, valves, ducts).

Prerequisites: The applicable prerequisite checklist items listed in the beginning of Section 15997 Part 1.3 shall be completed prior to functional testing. The CA will also spot-check miscellaneous items and calibrations on the prefunctional checklists previously completed by the installer, before the beginning of FPTs.

Functions / Modes Required To Be Tested, Test Methods and Seasonal Test Requirements: The following testing requirements are an addition to and do

not replace any testing requirements elsewhere in this Division.

Function / Mode	Test Method	Required
	Manual,	Seasonal
	Monitoring,	Test
	Either or Both	

General

1. Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, unoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks with which it is associated.

Both

In addition to, or as part of (1) above, the following modes or tests are required:

2. Supply air, & reset temperature control functions.

Both

3. Exhaust fan interlocks.

Both

4. Gas modulation control during heating.

Both

5. Damper interlocks and correct modulation in all modes, including smoke and fire dampers.

Manual

6. Temperature difference across HC per specifications.

Manual

7. Unit freeze protection.

Manual

8. All alarms (low limits, etc.).

Manual

9. Sensor and Actuator Calibration Checks: SAT, OSA damper and Variable speed modulation with TAB, and other random checks (EMS readout against hand-held calibrated instrument or observation must be within specified tolerances). Manual

10. Verify schedules and set points to be reasonable and appropriate.

Cooling season, Heating season or Both. A blank cell denotes no special seasonal test is required and that test can be executed during any season, if condition simulation is appropriate.

Seasonal test not required if seasonal conditions can be adequately simulated.

Required Monitoring:

All points listed below, which are control system monitored points shall be trended by the controls contractor. Additional points may be added during functional testing. Refer to the Monitoring section at Section 15997.1.4 for additional monitoring details.

Point	Time Step (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)
For each AHU being tested:				
SAT	10	48 hours	Y	Y
Exhaust fan status	10	48 hours	Y	Y
OSAT	10	48 hours	Y	Y
Zone temperature and set point	10	48 hours	Y	Y

Acceptance Criteria:

For the conditions, sequences and modes tested, the AHU, integral components and related equipment respond to varying loads and changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

AHU with supporting systems shall be able to maintain the SA temperature within 2.00F either side of the deadband of the current set point without excessive hunting.

END OF REQUIREMENTS FOR MAKE-UP AHU TEST

2.3 BLOWER UNITS

Parties Responsible to Execute Functional Test

Controls Contractor: Operate the controls to activate the equipment.
 HVAC Mechanical Contractor of Vendor: Assist in testing sequence.
 CA: Witness, direct, and document testing.

Integral Components or Related Equipment Being Tested:

Blower Units (fans, coils, valves, ducts).
 Air door AHU's (fans, coils, valves, ducts).

Prerequisites: The applicable prerequisite checklist items listed in the beginning of Section 15997 Part 1.3 shall be completed prior to functional testing. The commissioning authority will also spot-check misc. items and calibrations on the prefunctional checklists previously completed by the installer, before the beginning of functional testing.

Functions / Modes Required To Be Tested, Test Methods and Seasonal Test Requirements: The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Division.

Function / Mode	Test Method Manual, Monitoring,	Required Seasonal Test
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General

1. Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, warm-up, shutdown, unoccupied & manual modes and power failure and restoration. Test functionality of this piece of equipment or system in all control strategies or interlocks that it is associated with, including all valve and fan functions. Both

In addition to, or as part of (1) above, the following modes or tests are required:

2. Sensor calibration checks on: SAT, zone air temperature and other random checks (EMS readout against visual or hand-held calibrated instrument must be within 0.5°F for temps. Manual

3. Device and actuator calibration and stroke checks for heating coil valve. Manual

4. Verify no hunting or significant overshoot by valves. Either

5. Verify by measurement, HCV positive shutoff (no leak-thru). Manual

6. All alarms (fan status, low limits, etc.) Manual

7. Verify that Unit is maintaining space set point temperatures. Monitoring Both

NOTES:

Cooling season, Heating season or Both. A blank cell denotes no special seasonal test is required and that test can be executed during any season, if condition simulation is appropriate.

Special Procedures: None.

Required Monitoring:

All points listed below, which are monitored points of the control system, shall be trended by the controls contractor. Additional points may be added during functional testing. Refer to the Monitoring section at Section 15997.1.4 for additional monitoring details.

Point	Time Step (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)
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For each zone thermostat and space sensor and other critical areas, monitor:				
Heating coil valve	10	48 hours	Y	Y
Supply air temp	10	48 hours	Y	Y

Return air temp	10	48 hours	Y	Y
Zone temperature	10	48 hours	Y	Y
Fan status	10	48 hours	Y	Y
All associated setpoints	10	48 hours	Y	Y

Acceptance Criteria:

For the conditions, sequences and modes tested, the Blower units, integral components and related equipment respond to varying loads and changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice. Space temperature during occupied modes shall average within +/- 1°F of set point and always remain within 1°F of the ends of the deadband without excessive hunting of the coil valve, or complaints of drafts or stuffiness from occupants.

END OF REQUIREMENTS FOR BLOWER UNIT TEST

2.4 HOT WATER SYSTEM

Parties Responsible to Execute Functional Test:

Controls Contractor: Operate the controls, as needed.
 HVAC Mechanical Contractor or Vendor: Assist in testing sequences.
 CA: Witness, direct and document testing.

Integral Components or Related Equipment Being Tested:

Steam Heat Exchanger.
 HW supply pumps.
 Heating water piping system.

Prerequisites The applicable prerequisite checklist items listed in the beginning of Section 15997 Part 1.3 shall be completed prior to functional testing. The commissioning authority will also spot-check misc. items and calibrations on the prefunctional checklists previously completed by the installer, before the beginning of functional testing.

Functions / Modes Required To Be Tested, Test Methods and Seasonal Test Requirements: The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Division.

Function / Mode	Test Method	Required
	Manual,	Seasonal
	Monitoring,	Test
	Either or Both	

General

1. Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, unoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks that it is associated with. Both

In addition to, or as part of (1) above, the following modes or tests are required:

2. Modulation of Steam valves for Hot Water Temperature Control and HWT reset.	Both	Heating
3. HW supply pump staging.	Both	Heating
4. Check all alarms and safeties (high and low pressure and temperature, etc.), PRV and flow switch functions.	Manual	Heating
5. Test each possible lead pump as lead pump. Test pump lockouts.	Manual	Heating
6. Sensor and actuator calibration checks on: HWST, HWRT, steam valve actuation, and other random checks (EMS readout against hand-held calibrated instrument must be within 1.0°F for temps. or within a tolerance equal to 10% of the pressure set point, with a test gage).	Both	Heating
7. Verify schedules and set points to be reasonable and appropriate.		

Cooling season, Heating season or Both. A blank cell denotes no special seasonal test is required and that test can be executed during any season, if condition simulation is appropriate.

Special Procedures:

False load boiler, if necessary.

Required Monitoring:

All points listed below which are control system monitored points shall be trended by the controls contractor. Additional points may be added during functional testing. Refer to the Monitoring section at Section 15997.1.4 for additional monitoring details.

Point	Time Step (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)
For each boiler and pump:				
Steam Valve position	10	48 hours	Y	Y
HWST	10	48 hours	Y	Y
HWRT	10	48 hours	Y	Y
OSAT-DB	10	48 hours	Y	Y
HWS pump status	10	48 hours	Y	Y

Acceptance Criteria (referenced by function or mode ID).

For the conditions, sequences and modes tested, the heat exchanger,

integral components and related equipment respond to varying loads and changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

Heat Exchanger output shall maintain the supply water set point to within +/- 5.0F of set point deadband without excessive hunting.

END OF REQUIREMENTS FOR HOT WATER SYSTEM TEST

2.5 VAV BOXES

Parties Responsible to Execute Functional Test:

Controls Contractor: Operate the controls to activate the equipment.

HVAC Mechanical Contractor or Vendor: Assist in testing sequence as needed.

CA - witness, direct, and document testing.

Integral Components or Related Equipment Being Tested:

Reheat coil valves.

Prerequisites: The applicable prerequisite checklist items listed in the beginning of Section 15997 Part 1.3 shall be completed prior to functional testing. The commissioning authority will spot-check miscellaneous items and calibrations on the prefunctional checklists previously completed by the installer, before the beginning of functional testing.

Functions / Modes Required To Be Tested, Test Methods and Seasonal Test Requirements: The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Division.

Function / Mode	Test Method	Required
	Manual, Monitoring, Either or Both	Seasonal Test

General

1. Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including warm-up, unoccupied & manual modes and power failure and restoration. Test functionality of this piece of equipment or system in all control strategies or interlocks that it is associated with, including all valve and fan functions. Both

In addition to, or as part of (1) above, the following modes or tests are required:

2. Sensor calibration checks: Zone temperature and other random checks (EMS readout against visual or hand-held calibrated instrument must be within 1.0°F for temps. Both

3. Device and actuator calibration and stroke checks for heating coil valve.	Manual	
4. Verify control parameters and set points to be reasonable and appropriate by reviewing the full program of 5% of all the VAV's with each other for consistency. Verify programming parameters such as deadbands, set points, stroke times, etc.	Observation	
5. Verify minimum and maximum airflow control.	Both	
6. Verify no hunting or significant overshoot by heating valves.	Both	
7. Verify by measurement, HCV positive shutoff (no leak-thru).	Both	
8. All alarms (fan status, low limits, etc.)	Manual	
9. Verify that terminal units are maintaining space set point temperatures	Both	Both

NOTES:

Cooling season, Heating season or Both. A blank cell denotes no special seasonal test is required and that test can be executed during any season, if condition simulation is appropriate.

Special Procedures: None.

Required Monitoring:

All points listed below, which are monitored points of the control system, shall be trended by the controls contractor. Additional points may be added during functional testing. Refer to the Monitoring section at Section 15997.1.4 for additional monitoring details.

Point	Time Step (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)
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For each zone thermostat and space sensor and other critical areas, monitor:

Space Setpoint	5	10 hours, occupied	Y	Y
Space temperature	5	10 hours, occupied	Y	Y
Heating coil valve	5	10 hours, occupied	Y	Y
Terminal unit airflow	5	10 hours, occupied	Y	Y

Acceptance Criteria:

For the conditions, sequences and modes tested, verify the integral components and related equipment response to varying loads and changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

Space temperature during occupied modes shall average within +/- 1°F of setpoint and always remain within 1°F of the ends of the deadband without excessive hunting of the coil valve, or complaints of drafts or stuffiness from occupants.

Sampling Strategy for Identical Units of the same type and function, but different in size, are considered identical for sampling purposes.

Testing. Randomly test at least 10% of each group of identical equipment (the 1st sample). In no case test less than three units in each group. If 10% of the units in the first sample fail the functional performance tests, test another 10% of the group (the 2nd sample). If 10% of the units in the 2nd sample fail, test all remaining units in the whole group, fully at the contractor's expense. This sampling applies to the testing subsections. That is, if calibration is off on more than 10% of the tested piece of equipment, then another sample shall have calibrations checked, but not all other tests need to be done on the second sample.

Monitoring. Ten percent of the total number of zones in the building, chosen by the CA, shall be monitored. Within this 10%, shall be included a distribution of all air handlers, zones expected to have the greatest heating and cooling demand, perimeter and core zones and zones identified from the commissioning process that have exhibited potential problems.

END OF REQUIREMENTS FOR VAV TEST

2.6 BUILDING AUTOMATION SYSTEM (BAS)

Parties Responsible to Execute Functional Test:

Controls Contractor: Operate the controls to activate the equipment.
CA: Witness, direct and document testing.

Integral Components or Related Equipment Being Tested:

Building Automation System.
All prefunctional checklists of controlled equipment.

Prerequisites: The applicable prerequisite checklist items listed in the beginning of Section 15997 Part 1.3 shall be completed prior to functional testing. The commissioning authority will also spot-check misc. items and calibrations on the prefunctional checklists previously completed by the installer, before the beginning of functional testing.

A significant part of the BAS functional testing requirements is the successful completion of the functional tests of equipment the BAS controls or interlocks with. Uncompleted equipment functional tests or outstanding deficiencies in those tests lend the required BAS functional testing incomplete.

Integral or stand-alone controls are functionally tested with the equipment they are attached to, including any interlocks with other equipment or

systems and thus are not covered under the BAS testing requirements, except for any integrated functions or interlocks listed below.

In addition to the controlled equipment testing, the following tests are required for the BAS, where features have been specified. The following testing requirements are in addition to and do not replace any testing requirements elsewhere in the specifications.

Function / Mode	Test Method
	Manual (demonstration), Monitoring, Either or Both
MISC. FUNCTIONS	
1. All specified functions and features are set up, debugged and fully operable.	Verbal discussion of features
2. Power failure and battery backup and power-up restart functions.	Demonstration
3. Specified trending demonstration.	See equipment trends
4. Global commands features.	Demonstration
5. Security and access codes.	Demonstration
6. Occupant over-rides (manual, telephone, key, keypad, etc.)	Demonstration
7. O&M schedules and alarms.	Demonstration
8. Scheduling features fully functional and setup, including holidays	Observation in terminal screens or printouts
9. Demonstrate functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad	Demonstration of 100% of panels and 10% of ports
10. Setpoint changing features and functions	Done during equipment testing
11. Sensor calibrations	Sampled during equipment tests
12. Final as-builts or redlines (per spec) control drawings, final points list, program code, setpoints, schedules, warranties, etc. per specs, submitted for O&Ms.	Observation
13. Verify that points that are monitored only, having no control function, are checked for proper reporting to BAS.	Observation

INTEGRATED TESTS

- | | |
|--|---------------|
| 14. Fire alarm interlocks and response. | Demonstration |
| 15. Sequential staging ON of equipment. | Either |
| 16. Optimum start-stop functions. | Monitoring |
| 17. All control strategies and sequences not tested during controlled equipment testing. | Either |

Special Procedures (other equipment to test with, etc.; reference to function ID): None.

Additional Required Monitoring: None.

Acceptance Criteria: For the conditions, sequences and modes tested, the BAS, integral components and related equipment respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

END OF REQUIREMENTS FOR BAS TEST

2.7 TEST AND BALANCE WORK (TAB)

Parties Responsible to Execute Functional Test:

TAB Contractor: Perform checks using test instruments.
Controls contractor: Operate the controls to activate the equipment.
CA: Witness, direct and document testing.

Integral Components or Related Equipment Being Tested:

TAB water-side.
TAB air-side.

Prerequisites: The applicable prerequisite checklist items listed in the beginning of Section 15997 Part 1.3 shall be completed prior to functional testing. The commissioning authority will also spot-check misc. items and calibrations on the prefunctional checklists previously completed by the installer, before the beginning of functional testing.

Purpose: The purpose of this test is to spot check the TAB work to verify that it was done in accordance with the contract documents and acceptable practice and that the TAB report is accurate.

The following tests and checks will be conducted. The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Division.

Test or Check	Test Method	Required Seasonal Test
---------------	-------------	---------------------------

1. A random sample of up to 10% the TAB report data shall be selected for verification (air velocity, air or water

flow rate, pressure differential, etc.)).
The original TAB contractor will execute
the checks, witnessed by the commissioning
authority. The TAB contractor will use
the same test instruments as used in the
original TAB work.

Demonstration

A failure of more than 10% of the selected
items of a given system shall result in the
failure of acceptance of the system TAB report
and the TAB contractor shall be responsible to
rebalance the system, provide a new system TAB
report and repeat random verifications of the
new TAB report.

The random testing will include the verification
of minimum outdoor air intake flows at minimum,
maximum and intermediate total airflow rates for
one of the air handlers. Other selected data to
be verified will be made known upon day of
testing.

Demonstration

Verify that final settings of all valves, splitters,
dampers and other adjustment devices have been
permanently marked by the TAB Contractor.

Demonstration

Failure of an item is defined as follows:

For airflow of supply and return: A deviation of more than 10% of
instrument reading.

For minimum outside airflow: 20% of instrument reading.

For temperatures: A deviation of more than 1°F.

For air and water pressures: A deviation of more than 10% of full
scale of test instrument reading.

Examples of a "system" are the air distribution system served by one air
handler. Systems can be defined smaller if inaccuracies in TAB work within
the smaller defined system will have little or no impact on connected
systems.

Cooling season, Heating season or Both. A blank cell denotes no special
seasonal test is required and that test can be executed during any season,
if condition simulation is appropriate.

Special Procedures: None.

Required Monitoring: None.

Acceptance Criteria: Provided in footnote to test table above.

Sampling Strategy for Identical Units: Described in test table above.

END OF REQUIREMENTS FOR TAB TEST

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION 16003

GENERAL ELECTRICAL PROVISIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z535.1 (2002) Safety Color Code

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M (2002) Standard Specification for Zinc
(Hot-Dip Galvanized) Coatings on Iron and
Steel Products

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2002) National Electrical Safety Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

U.S. DEPARTMENT OF DEFENSE (DOD)

MS MIL-T-704 (Rev K) Treatment and Painting of Material

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-59214 (2004) Junction Box: Extension, Junction
Box; Cover, Junction Box (Steel, Coated
With Corrosion-Resistant Finish)

UNDERWRITERS LABORATORIES (UL)

UL Elec Const Dir (2003) Electrical Construction Equipment
Directory

1.2 SUBMITTALS

Not Used

1.3 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

It is the intent of these specifications and the contract drawings to
provide a complete and workable facility.

Design drawings are diagrammatic and do not show all offsets, bends, elbows, or other specific elements that may be required for proper installation of the work. Such work shall be verified at the site. Additional bends and offsets, and conduit as required by vertical and horizontal equipment locations or other job conditions, shall be provided to complete the work at no additional cost to the Government.

Except where shown in dimensional detail, the locations of switches, receptacles, lights, motors, outlets, and other equipment shown on plans are approximate. Such items shall be placed to eliminate interference with ducts, piping, and equipment. Exact locations shall be determined in the field. Door swings shall be verified to ensure that light switches are properly located on latch sides.

Equipment sizes indicated are minimum. Before installing any wire or conduit, the Contractor shall obtain the exact equipment requirements and shall install wire, conduit, disconnect switches, motor starters, heaters, circuit breakers, and other items of the correct size for the equipment actually installed. Wire and conduit sizes shown on the drawings shall be taken as a minimum and shall not be reduced without written approval.

1.4 CODES AND STANDARDS

Equipment design, fabrication, testing, performance, and installation shall, unless shown or specified otherwise, comply with the applicable requirements of NFPA 70 and IEEE C2 to the extent indicated by the references.

1.5 COORDINATION

Installation of the electrical work shall be coordinated with the work of all other trades.

1.6 APPROVAL REQUIREMENTS

Where materials and equipment are specified to conform to the standards of the Underwriters Laboratories (UL), Inc., the label of, or listing with re-examination, in UL Elec Const Dir will be acceptable as sufficient evidence that the items conform to the requirements.

Where materials or equipment are specified to be constructed or tested in accordance with the standards of NEMA, ANSI, ASTM, or other recognized standards, a manufacturer's certificate of compliance indicating complete compliance of each item with the applicable NEMA, ANSI, ASTM, or other commercial standards specified will be acceptable as proof of compliance.

1.7 PREVENTION OF CORROSION

Metallic materials shall be protected against corrosion. Equipment enclosures shall be given a rust-inhibiting treatment and the standard finish by the manufacturer when used for most indoor installations. For harsh indoor environments (any area subjected to chemical and/or abrasive action), and all outdoor installations, refer to Section 09960 HIGH

PERFORMANCE COATINGS.. Aluminum shall not be used in contact with earth or concrete. Dissimilar metals in intimate contact shall be protected by approved fittings, barrier material, and treatment. Ferrous metals such as anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of corrosion-resistant steel or nonferrous materials shall be hot-dip galvanized in accordance with ASTM A 123/A 123M for exterior locations and cadmium-plated in conformance with FS A-A-59214 for interior locations.

1.8 HAZARDOUS AREA

Electrical work within any hazardous location shall meet the applicable requirements of NFPA 70, Chapter 5, Articles 500 through 517. The following definitions apply:

Explosionproof: A receptacle, fixture, device, or equipment enclosure that is designed to withstand explosion of a specified liquid, gas, vapor, or dust within the enclosure and to prevent the ignition of a specified gas, vapor, or dust surrounding the enclosure by sparks, flashes, or explosions of the specified liquid, gas, vapor, or dust that may occur within the enclosure. Enclosure shall be capable of operating at an external temperature that will not ignite a surrounding flammable atmosphere.

Hazardous location: An area where ignitable vapors or dust may cause a fire or explosion created by energy emitted from lighting or other electrical equipment or by electrostatic generation.

NFPA 70, Article 500-2 lists chemical atmospheres by groups A, B, C, and D. In addition, although not defined as a hazardous material by the NEC, oxygen concentrations (liquid and gaseous) are considered to provide a hazard because of the increased flammability of materials exposed to oxygen. Therefore, oxygen concentrations shall be classified under Group D.

PART 2 PRODUCTS

2.1 IDENTIFICATION PLATES

Identification plates shall be 2-layer black-white, engraved to show black letters on a white background. Letters shall be uppercase. Identification plates 1-1/2 inches high and smaller shall be 1/16-inch thick with engraved lettering 1/8-inch high. Identification plates larger than 1-1/2 inches high shall be 1/8-inch thick with engraved lettering not less than 3/16-inch high. Identification plates having edges of 1-1/2 inches high and larger shall be beveled.

2.2 WARNING SIGNS

Each item of electrical equipment operating at 480 volts and above shall be provided with conspicuously located warning signs conforming to the requirements of Occupational Safety and Health Agency (OSHA) standards.

Any equipment with externally powered wiring shall be marked with a

laminated plastic nameplate having 3/16-inch high white letters on a red background as follows:

DANGER - EXTERNAL VOLTAGE SOURCE

Safety color coding for identification of warning signs shall conform to ANSI Z535.1.

2.3 ANCHOR BOLTS

Anchor bolts shall be provided for equipment placed on concrete equipment pads or slabs.

2.4 SEISMIC ANCHORAGE

Electrical equipment, except communications, emergency, and standby equipment, shall be anchored to withstand a lateral force of 0.3 times the weight of the equipment.

Communications, emergency, and standby equipment shall be anchored to withstand a lateral force of 0.6 times the weight of the equipment.

The following standard anchoring should be adequate for equipment not classified as communications, emergency, or standby:

Dry transformers - floor-mounted with four anchor bolts

BOLT DIAMETER

Under 150 kVA	-	3/8
150 to 500 kVA	-	1/2
Over 500 kVA	-	5/8

Panels - floor-mounted with four 1/2-inch diameter anchor bolts

2.5 PAINTING

Enclosures of the following listed items shall be cleaned, primed, and factory-painted inside and outside in accordance with MS MIL-T-704 and the equipment sections of this specification. [Refer to Section 09960 HIGH PERFORMANCE COATINGS, for requirement for outdoors or in harsh environments.]

ITEM	FINISH COLOR
Circuit Breakers	ANSI No. 61 gray
Switchgear	ANSI No. 61 gray
Transformers	ANSI No. 61 gray
Safety Switches	Manufacturer's standard
Panelboards	Manufacturer's standard

ITEM	FINISH COLOR
Electric Heaters	Manufacturer's standard
Motors	Manufacturer's standard
Limit Switches	Manufacturer's standard
Control Components	Manufacturer's standard

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be accomplished by workers skilled in this type of work. Installation shall be made so that there is no degradation of the designed fire ratings of walls, partitions, ceilings, and floors. Except as otherwise indicated, emergency switches and alarms shall be installed in conspicuous locations.

3.2 PAINTING APPLICATION

Exposed conduit, supports, fittings, cabinets, pull boxes, and racks, if not factory painted, shall be thoroughly cleaned and painted as specified in [Section 09920 ARCHITECTURAL PAINTING] unless otherwise noted. Work shall be left in a neat and clean condition at final completion of the contract.

Emergency equipment, such as fire-alarm boxes and conduit, shall be cleaned, primed, and painted red.

3.3 IDENTIFICATION PLATE INSTALLATION

Identification plates shall be fastened by means of corrosion-resistant steel or nonferrous metal screws. Hand lettering, marking, or embossed self-adhesive tapes are not acceptable.

3.4 EQUIPMENT PADS

Equipment pads shall be constructed with a minimum 4-inch depth and 4-inch margin around the equipment and supports.

3.5 CUTTING AND PATCHING

Contractor shall install his work in such a manner and at such time as will require a minimum of cutting and patching on the building structure.

3.6 DAMAGE TO WORK

Required repairs and replacement of damaged work shall be done as directed by and subject to the approval of the Contracting Officer, and at no additional cost to the Government.

3.7 CLEANING

Exposed surfaces of wireways, conduit systems, and equipment that have become covered with dirt, plaster, or other material during handling and

construction shall be thoroughly cleaned before such surfaces are prepared for final finish or painting or are enclosed within the building structure.

Before final acceptance, electrical equipment, including lighting fixtures and glass, shall be clean and free from dirt, grease, and fingermarks.

3.8 FIELD TESTING AND TEST EQUIPMENT

All Field testing specified in Divisions 16 electrical specification shall be made with test equipment specially designed and calibrated for the purpose. Test equipment used shall be calibrated and certified by an approved testing laboratory. Date of last calibration and certification shall not be more than 90 calendar days old at the time of field testing.

-- End of Section --

SECTION 16065

SECONDARY GROUNDING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ASTM INTERNATIONAL (ASTM)

ASTM B 3 (2001) Standard Specification for Soft or Annealed Copper Wire

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE Std 81 (1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD 889 (Rev B, Notice 2) Dissimilar Metals

UNDERWRITERS LABORATORIES (UL)

UL 467 (2001) UL Standard for Safety Grounding and Bonding Equipment

1.2 GENERAL REQUIREMENTS

[Section 16003 GENERAL ELECTRICAL PROVISIONS applies to work specified in this section.]

[Section 05095 WELDING STEEL CONSTRUCTION applies to work specified in this section.]

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Material, equipment, and fixture lists shall be submitted for

Grounding Systems including manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site information.

SD-02 Shop Drawings

As-Built Drawings shall be submitted in accordance with paragraph entitled, "Drawings," of this section.

SD-03 Product Data

Equipment and performance data shall be submitted for the following items including life, test, system functional flows, safety features, and mechanical automated details.

Manufacturer's catalog data shall also be submitted for the following items:

- Ground Rods
- Ground Wires
- Connectors and Fasteners
- Bonding

SD-06 Test Reports

Test Reports shall be submitted for the following tests on grounding systems in accordance with the paragraph entitled, "Field Tests," of this section. Report shall include certified record of ground-resistance tests on each driven ground rod, ground rod assembly, and other grounding electrodes. Record shall include the number of rods driven and their depth at each location to meet the required resistance-to-ground measurements specified. A statement shall be included describing the condition of the soil at the time of measurement.

- Bond Resistance Test
- Ground Resistance Tests
- Ground Isolation Test
- Continuity Isolation Test

SD-08 Manufacturer's Instructions

Manufacturer's instructions shall be submitted for the Grounding Systems including special provisions required to install equipment components and system packages. Special notices shall detail impedances, hazards and safety precautions.

1.4 DRAWINGS

As-Built Drawings shall indicate the dimensioned locations of ground rods, mats, grids, building ground bus, supplementary grounding electrodes, steel building columns, and other metal structures connected to the grounding system.

Location of each ground rod and ground-rod assembly and other grounding electrodes shall be identified by letter in alphabetical order and keyed to the record of ground-resistance tests.

PART 2 PRODUCTS

2.1 GROUND RODS

Ground rods shall conform to the requirements of NFPA 70 UL 467 .

Ground rods shall be copper-clad steel rods not less than 3/4 inch in diameter and not less than 10-feet long per section. Ground rods shall be clean and smooth and have a cone-shaped point on the first section and shall be die-stamped near the top with the name or trademark of the manufacturer and the length of the rod in feet.

2.2 GROUND WIRES

Ground wires shall be in accordance with Section 16145 STANDARD WIRING SYSTEMS.

Ground and bond wires for main panels and distribution points, and ground rod connections shall be annealed bare copper conforming to ASTM B 3, stranded, with 98 percent conductivity. Wire size shall be in accordance with the grounding requirements of NFPA 70.

Ground wires for equipment receptacles for noncurrent carrying hardware, installed in conduit shall be soft drawn copper, in accordance with ASTM B 3, stranded, with green insulation. Wire size shall be as noted.

2.3 CONNECTORS AND FASTENERS

Grounding and bonding fasteners and connectors shall conform to the requirements of UL 467, and Section 16145 STANDARD WIRING SYSTEMS.

Grounding and bonding fasteners shall be bronze.

Bonding straps and jumpers shall be copper and shall have a cross-sectional area of not less than No. 6 AWG. Bonding straps and jumpers for shock-mounted devices with pivot joints shall be made of woven-wire braid wire.

PART 3 EXECUTION

3.1 BONDING AND GROUNDING

Bonding and grounding requirements shall be in accordance with NFPA 70.

3.2 GROUNDING ELECTRODES

Grounding electrodes shall include ground rods installed expressly for grounding systems.

Minimum ground rod section shall be 10 feet. Sections shall be threaded

together and exothermically fusion welded.

Ground rods shall be installed so that the top of the rod is not less than 6 inches below finished grade.

3.3 BUILDING GROUNDS

Steel framework of the building shall be grounded with a driven ground rod at the base of every corner column and intermediate exterior columns at distances not greater than 60-feet apart. Grounding conductor shall be electrically connected to each ground rod and to each steel column and shall extend around the perimeter of the building. Grounding-conductor loop around the perimeter of the building shall be not less than No. 4/0 AWG diameter. Tap connections from the ground loop to the building steel shall be not less than No. 4/0 AWG.

Building ground shall be buried not less than 18 inches below grade and 2 feet from the building foundation. Interconnecting grounding conductor between ground grid and building grounds shall be not less than No. 4/0 AWG.

3.4 EQUIPMENT GROUNDING

Metallic raceway systems shall have electrical continuity with equipment individually and directly connected to the building ground, independent of the raceway system.

Enclosures for panelboards shall be individually and directly connected to the building ground. Grounding conductor shall be not less than No. 2 AWG and shall be connected from the building ground to a copper ground-bus terminal strip located in each panelboard.

Polarized receptacles, lighting fixtures, and equipment enclosures shall be grounded with an identified (green color) insulated conductor, not smaller than No. 12 AWG, connected to the branch circuit ground-bus terminal strip.

Ground-bus terminal strip in each panelboard enclosure shall be isolated and independent of the system neutral terminal strip.

Indoor transformers, switchboard frames, motors, air compressors, air handlers, refrigerated air dryers, frames and tracks of cranes shall be individually and directly connected and grounded to the building ground. Current-carrying capacity of the grounding conductor shall be the same as the current-carrying capacity of the power conductors for circuits utilizing power lines size No. 2 AWG and smaller. For circuits with power wiring larger than No. 2 AWG, the grounding conductor shall be in accordance with NFPA 70, except that the grounding conductor shall be not smaller than No. 2 AWG.

Noncurrent carrying metallic parts of electrical equipment, including metallic cable sheaths, conduit, raceways, and electrical structural members, shall be bonded together and connected to the ground grid or ground connection rods.

3.5 GROUNDING CONNECTIONS

Ground connections shall be bonded connections in accordance with paragraph entitled, "Bonding."

Ground connections that are buried or in inaccessible locations shall be welded.

Connections in accessible locations shall be bolted. Connections to steel building columns in accessible locations shall be cast-copper-alloy clamp lugs exothermically fusion-welded to the structure.

Ground connection surfaces shall be cleaned and greased and foreign matter removed. Clad material shall not be penetrated in the cleaning process. Connection shall be made between like metals where possible. Where dissimilar metals are welded, brazed, or clamped, the weld kit manufacturer's instructions shall be followed. Connections between dissimilar metals shall not produce galvanic action in accordance with MIL-STD 889.

3.6 BONDING

3.6.1 Type of Bonds

Bonding of metal surfaces shall be accomplished by welding or clamping methods.

3.6.1.1 Welding

Welding shall be by the exothermic process. Welding procedure shall include the proper mold and powder charge and shall conform to the manufacturer's recommendations.

Welding processes shall be of the exothermic fusion type that will make a connection without corroding or loosening. Process shall join all strands and shall not cause the parts to be damaged or weakened. Completed connection or joint shall be equal or larger in size than the conductors joined and shall have the same current-carrying capacity as the largest conductor. Buried ground connections shall be painted with a bitumastic paint.

3.6.1.2 Clamping

In external locations, clamping shall be used only where a disconnect type of connection is required. Connection device may utilize threaded fasteners. Device shall be constructed such that positive contact pressure shall be maintained at all times. Machine bolts with [tooth-type] [spring-type] lockwashers shall be used.

3.6.2 Cleaning of Bonding Surfaces

Surfaces that comprise the bond shall be thoroughly cleaned before joining. An appropriate abrasive shall be applied with a gentle and uniform pressure to ensure a smooth and uniform surface. Excessive metal shall not be removed from the surface. Clad metals shall be cleaned in such a manner

that the cladding material is not penetrated by the cleaning process. Bare metal shall then be cleaned with an appropriate solvent to remove any grease, oil, dirt, corrosion preventives, and other contaminants. Bond to the cleaned area shall be made within one hour after cleaning. Joint shall be sealed and the exposed surfaces refinished within two hours of exposure to prevent oxidation. When additional time is required, a corrosion preventive compound shall be applied until the area can be refinished.

3.6.3 Bonding Straps and Jumpers

Jumpers shall be installed such that the vibration by the shock-mounted device shall not change its electrical characteristics.

Bonds shall be welded for outdoor locations unless a disconnect type of connection is required. When a disconnect is required, clamping with bolts shall be used. A tooth-type lockwasher shall be inserted between the strap and metallic member for each bolt.

Straps shall be bonded directly to the basic structure and shall not penetrate any adjacent parts. Straps shall be installed in an area that is accessible for maintenance.

Single straps shall be used for the bonds and shall be installed such that they will not restrict movement of structural members. Two or more straps shall not be connected in series.

Straps shall be installed such that they will not weaken structural members to which they are attached.

3.6.4 Equipment and Enclosure Bonding

Each metallic enclosure and all electrical equipment shall be bonded to ground. At least one copper connection shall be made from the system ground point to one or more enclosures in the area such that all enclosures and equipment provide a low-impedance path to ground when properly bonded together.

3.6.5 Bonding of Conduit and Raceway Systems

Bond all metal conduit, fittings, junction boxes, outlet boxes, and other raceways. Care shall be taken to ensure adequate electrical contact at the joints and terminations.

3.6.5.1 Rigid Metal Conduit and Terminations

Threaded connections must be wrench-tight and there shall be no exposed threads. All ends of the conduit shall be reamed to remove burrs and rough edges. Conduits entering boxes and enclosures shall be bonded to the box with locknuts and grounding-type bushings. Locknuts that gouge into the metal box when tightened are not acceptable.

Conduit systems that are interrupted by PVC dielectric links shall be bonded separately on either side of the link. Dielectric link shall not be jumpered.

3.6.5.2 Flexible Metal Conduit

Flexible conduit shall have an integral grounding conductor.

3.6.6 Cable Tray Bonding

Cable tray sections shall be bonded together. Cable tray sections in tandem assembly shall be considered as having electrical continuity when these sections are bonded with the appropriate bolts. Bond straps shall be installed across expansion joints. Cable trays shall be bonded to the building ground system.

3.6.7 Protection of Finished Bonds

Finished bonds shall be protected by painting to match the original finish after the bond is made.

3.7 FIELD TESTS

The following tests shall be performed by the Contractor in the presence of the Contracting Officer.

3.7.1 Bond Resistance Test

Resistance of any bond connection shall not exceed 0.5 milliohm. Bonds that exceed this resistance shall be reworked by the Contractor at no additional cost to the Government.

3.7.2 Ground Resistance Tests

Grounding systems shall be tested for ground resistance. Total resistance from any point on the ground network to the building counterpoise shall not exceed 50 milliohms.

Ground resistance and counterpoise tests shall be made during dry weather, and no sooner than 48 hours after rainfall. Tests shall be conducted using the ratio method that measures the ratio of the resistance to earth of an auxiliary test electrode to the series resistance of the electrode under test and a second auxiliary electrode. Measurements shall be performed in accordance with IEEE Std 81.

Indicating instrument shall be self-contained and shall include a direct-current generator, synchronized current and potential reversers, crossed-current and potential coils, direct-reading ohmmeter, series resistors, and range-selector switch. Direct-reading ohmmeter shall be calibrated for ranges of 0 to 20 ohms and 0 to 200 ohms.

Auxiliary grounding electrodes shall be placed in accordance with instrument manufacturer's recommendations but not less than 50 feet apart, in accordance with IEEE Std 81.

3.7.3 Ground Isolation Test

Ground systems shall be tested for isolation from other ground systems.

3.7.4 Continuity Isolation Test

Continuity test shall be performed on all power receptacles to ensure that the ground terminals are properly grounded to the facility ground system.

-- End of Section --

SECTION 16145

STANDARD WIRING SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|------------|---|
| ANSI C80.1 | (1994; R 1995) Rigid Steel Conduit - Zinc Coated |
| ANSI C80.3 | (1994; R 1995) Electrical Metallic Tubing - Zinc-Coated |
| ANSI C80.5 | (1994: R 1995) Rigid Aluminum Conduit |

ASTM INTERNATIONAL (ASTM)

- | | |
|-------------------|--|
| ASTM A 123/A 123M | (2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| ASTM D 2301 | (1999) Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape |

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- | | |
|------------|---|
| NEMA 250 | (2003) Enclosures for Electric Equipment (1000 Volts Maximum) |
| NEMA FB 1 | (2001) Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies |
| NEMA FB 11 | (2000) Plugs, Receptacles, and Cable Connectors of the Pin and Sleeve Type for Hazardous Locations |
| NEMA KS 1 | (2001) Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum) |
| NEMA RN 1 | (1998) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit |

NEMA TC 3	(2004) PVC Fittings for Use With Rigid PVC Conduit and Tubing
NEMA WC 5	(1992; R 1993) Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NEMA WD 1	(1999) General Requirements for Wiring Devices
NEMA WD 6	(2002) Wiring Devices - Dimensional Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code
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UNDERWRITERS LABORATORIES (UL)

UL 1	(2004) UL Standard for Safety - Flexible Metal Conduit
UL 1242	(2003) UL Standard for Safety - Intermediate Metal Conduit
UL 1581	(2003) UL Standard for Safety - Reference Standard for Electrical Wires, Cables, and Flexible Cords
UL 20	(2002) General-Use Snap Switches
UL 486C	(2002) UL Standard for Safety Splicing Wire Connectors
UL 50	(2003) UL Standard for Safety - Enclosures for Electrical Equipment
UL 514A	(2004) UL Standard for Safety - Metallic Outlet Boxes
UL 514B	(2004) UL Standard for Safety Fittings for Conduit and Outlet Boxes
UL 6	(2003) UL Standard for Safety for Electrical Rigid Metal Conduit-Steel
UL 651	(2002) UL Standard for Safety Schedule 40 and 80 Rigid PVC Conduit
UL 797	(2003) UL Standard for Safety - Electrical Metallic Tubing
UL 870	(2002) UL Standard for Safety Wireways, Auxiliary Gutters, and Associated Fittings

1.2 GENERAL REQUIREMENTS

Section 16003 GENERAL ELECTRICAL PROVISIONS applies to work specified in this section.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists shall be submitted for the following items showing manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site.

Conduit, Raceways and Fittings
Wire and Cable
Safety Switches
Flush Wiring Devices
Boxes and Fittings
Communication Cabinets

SD-02 Shop Drawings

The following types of drawings shall be submitted to check for contract conformity:

Fabrication Drawings
Assembly Drawings

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Conduit, Raceways and Fittings
Wire and Cable
Safety Switches
Flush Wiring Devices
Boxes and Fittings
Communication Cabinets

SD-06 Test Reports

Test Reports shall be submitted for standard wiring systems in accordance with the paragraph entitled, "Field Testing," of this section.

SD-07 Certificates

Certificates of compliance shall be submitted for the following items showing conformance with the referenced standards contained in this section.

Conduit, Raceways and Fittings
Wire and Cable
Safety Switches
Flush Wiring Devices
Boxes and Fittings
Communication Cabinets

1.4 FABRICATION AND ASSEMBLY DRAWINGS

Fabrication Drawings shall be submitted for the standard wiring systems consisting of fabrication and Assembly Drawings for all parts of the work in sufficient detail to enable the Government to check conformity with the requirements for the contract documents.

PART 2 PRODUCTS

2.1 CONDUIT, RACEWAYS AND FITTINGS

Conduit shall be 3/4 inch diameter minimum, except where specifically shown smaller on the contract drawings, and except for exposed switch leg runs.

Conduit, connectors, and fittings shall be approved for the installation of electrical conductors.

2.1.1 Intermediate Metal Conduit

Intermediate metal conduit, including couplings, elbows, bends, and nipples, for use as a raceway for wire and cables in an electrical system shall conform to the requirements of UL 1242 as amended for thin or thick-wall types and shall also conform to NFPA 70. Interior and exterior surfaces of the conduit shall be protected with a metallic zinc coating.

2.1.2 Rigid Steel Conduit

Rigid steel conduit, including couplings, elbows, bends, and nipples, shall conform to the requirements of UL 6 and ANSI C80.1 ANSI C80.5 Steel fittings shall be galvanized by the hot-dip process. Where indicated, and in corrosive areas, rigid steel conduit shall be polyvinylchloride (PVC) coated and conform to NEMA RN 1, Type 20.

Fittings for rigid steel conduit shall be threaded and shall conform to NEMA FB 1.

Gaskets shall be solid for fittings sized 1-1/2 inches and less. Conduit fittings with blank covers shall have gaskets except in clean, dry areas or at the lowest point of a conduit run where drainage is required.

Covers shall have captive screws and shall be accessible after the work has been completed.

2.1.3 Rigid Plastic Conduit

PVC conduit shall be not lighter than Schedule 40. Rigid PVC shall be the slip-joint solvent-weld type, and fittings shall be unthreaded solid PVC. Conduit and fittings shall conform to UL 651 and NEMA TC 3.

2.1.4 Electrical Metallic Tubing (EMT)

EMT shall be rigid metallic conduit of the thinwall type in straight lengths, elbows, or bends and shall conform to ANSI C80.3 and the requirements of UL 797.

Couplings and connectors shall be hex-nut expansion-gland type, zinc-plated. Crimp, spring, or setscrew type fittings are not acceptable. Where EMT enters outlet boxes, cabinets, or other enclosures, connectors shall be the insulated-throat type, with a locknut. Fittings shall meet the requirements of NEMA FB 1.

2.1.5 Flexible Metallic Conduit

Flexible metallic conduit shall meet the requirements of UL 1.

Liquidtight flexible metallic conduit shall be provided with a protective jacket of PVC extruded over a flexible interlocked galvanized steel core to protect wiring against moisture, oil, chemicals, and corrosive fumes.

Fittings for flexible metallic conduit shall meet the requirements of UL 514B, Type I box connector, electrical, Type III coupling, electrical conduit, flexible steel, or Type IV adapter, electrical conduit.

Fittings for liquidtight flexible metallic conduit shall meet the requirements of UL 514B, Type I box connector, electrical, Class 3 liquidtight flexible metallic conduit connectors.

2.1.6 Wireways and Auxiliary Gutters

Wireways and auxiliary gutters for use in exposed, dry locations shall be a prefabricated channel-shaped sheet metal trough with hinged or removable covers, associated fittings, and supports for housing, and protecting electrical wires and cables in accordance with UL 870.

Straight sections of trough, elbows, tees, crosses, closing plates, connectors, and hanging brackets shall be constructed from sheet steel of commercial quality not less than 16-gage. Sheet metal component parts shall be cleaned, phosphatized, and coated with a corrosion-resistant gray paint.

Straight sections of wireways and auxiliary gutters shall be solid or have knockouts as indicated in both sides and bottom, 3 inches on center.

Straight sections shall be not more than 5-feet long, with hinged covers held closed with spring catches.

2.1.7 Surface Metal Raceways

Surface metal raceways shall conform to the requirements of NFPA 70. Minimum size shall equal or exceed the capacity of 1/2 inch trade size conduit.

2.2 WIRE AND CABLE

Insulated current-carrying wire and grounding conductors shall be copper and shall conform to NFPA 70 and UL 1581. Wire bundles with cable ties shall be secured to the enclosure with sheet-metal screws. Self-sticking adhesive attachments are not acceptable.

2.2.1 Building Wire

Building wire for use in conduits, raceways, and wireways shall be single-conductor, 600-volt, heat- and moisture-resistant insulated wire suitable for use in wet or dry locations.

Conductors AWG No. 10 and smaller shall be solid round copper wire. Conductors AWG No. 8 and larger shall be standard concentric stranded copper wire. Conductors shall be not less than AWG No. 12, except that AWG No. 14 shall be stranded copper wire and shall be used for control wiring.

Building wire shall be Type THWN with insulation of PVC and nylon jacket, with a minimum temperature rating of 90 degrees C.

2.2.2 Lighting-Fixture Wiring

Lighting-fixture wire for outlet-box connection to incandescent-fixture lampholders shall be flexible seven-strand copper wire with insulation conforming to NFPA 70.

Lighting-fixture wire for use in fluorescent fixture wiring channels shall be flexible seven-strand or solid copper wire conforming to NFPA 70.

2.2.3 Standard Flexible Cable

Flexible multiconductor cable shall conform to UL 1581 for control and power below 600 volts, noninstrumentation type. Cable shall contain one (green) grounding conductor and shall utilize a thermosetting or thermoplastic overall jacket in accordance with NEMA WC 5. A white conductor shall be included for the power neutral or grounded current-carrying conductor. Cable conductor insulation shall conform to NEMA WC 5.

2.2.4 Splices and Connectors

Splices in building wire AWG No. 8 and smaller and multiple conductor cables shall be made with insulated Scotchlock, or equal, connectors or with indenter crimp-type connectors and compression tools to ensure a satisfactory mechanical and electrical joint.

Splices in building wire AWG No. 6 and larger and single-conductor cables

shall be made with indenter crimp-type connectors and compression tools or with bolted clamp-type connectors to ensure a satisfactory mechanical and electrical joint.

Joints shall be wrapped with an insulating tape that has an insulation and temperature rating equivalent to that of the conductor. Splices in rubber-insulated neoprene-jacketed wire and cables shall be watertight.

Vinyl-plastic electrical insulating tape shall meet the requirements of ASTM D 2301. Where pressure-sensitive tape is used, the surface shall be cleaned free of dust, sand, or other foreign material and a primer recommended by the tape manufacturer shall be applied prior to taping.

Where indicated and for building wire AWG No. 8 and larger, terminations shall utilize screw-set pressure terminal lugs.

Where indicated, building wire AWG No. 10 and smaller shall be terminated in pre-insulated crimp ring lugs on terminal blocks.

Solid wiring shall be terminated with terminal blocks specifically designed for solid wire. Crimp type shall not be used on solid wire for termination.

Stranded wire shall use spade type lugs for termination on terminal blocks.

2.3 SAFETY SWITCHES

Switches shall comply with NEMA KS 1.

Safety switches shall be the heavy-duty type with voltage, current rating, number of poles, and fusing as indicated. Switch construction shall be such that, with the switch handle in the "ON" position, the cover or door cannot be opened. Cover release device shall be coinproof and shall be so constructed that an external tool (screwdriver) must be used to open the cover. Provisions shall be made to lock the handle in the "OFF" position, but the switch handle shall not be capable of being locked in the ON position.

Switches shall be the quick-make, quick-break type. Terminal lugs shall be approved for use with copper conductors.

2.4 FLUSH WIRING DEVICES

2.4.1 Wall Switches

Snap switches installed for the control of incandescent, mercury, and fluorescent lighting fixtures shall be heavy-duty, general-purpose, noninterchangeable flush devices conforming to UL 20 and NEMA WD 1, as indicated.

Snap switches shall be the toggle type: single-pole, three-way or four-way two-position devices rated 20 amperes at 277 volts, 60 hertz, ac only, meeting the requirements of UL 20.

All snap switches shall be made by the same manufacturer.

Where two or more snap switches are to be installed at the same location, they shall be mounted in one-piece ganged switch boxes, with a gang cover plate.

Combination snap switch and flush pilot light shall be interchangeable devices mounted in a one-gang switch box with a one-gang, two-opening cover plate. Pilot-light cover opening shall be fitted with a rectangular-shaped ruby-red plastic jewel in a metal frame.

2.4.2 Receptacles

Receptacles shall be 20-ampere, 125-volt ac, 2-pole, 3-wire, single or duplex grounded, conforming to NEMA FB 11, NEMA WD 1 and to the 5-20R configuration in NEMA WD 6.

Bodies of 20-ampere receptacles shall be phenolic compound supported by a mounting yoke having plaster ears. Contact arrangement shall be such that contact is made on two sides of an inserted blade. Each receptacle shall be side-wired with two screws per terminal, shall be provided with a third grounding pole, and shall be capable of receiving 2-wire, 3-pole parallel-blade caps. Third grounding pole shall be connected to a metal mounting yoke and shall be provided with a green-colored screw for grounding.

Power outlets for connection to 208 volt, single or three-phase, accircuits shall consist of single locking receptacles in industrial cast-metal enclosures with cast-aluminum bodies, angle adapters, and receptacle housings with spring-loaded hinged lift covers, conforming to NEMA 250 for the indicated voltage and current rating. Springs and hinge pins shall be corrosion-resistant steel. Screws and spring covers shall be chromium-plated brass. Rubber gaskets shall provide a positive seal against the entrance of dust, lint, fibers, and oil or coolant seepage.

Locking receptacles shall conform to NEMA WD 6. One plug shall be furnished with each locking receptacle.

Receptacles shall meet the requirements for retention of plugs, overload, temperature, and assembly security in accordance with NEMA WD 1.

2.4.3 Weatherproof Outlets

Convenience outlets installed in outdoor damp or wet locations for connection to 120-volt ac single-phase circuits shall consist of duplex Ground Fault Circuit Isolation (GFCI) receptacles enclosed in weatherproof outlet boxes, with gasketed cast-aluminum plates and spring-loaded hinged lift covers. Springs and hinge pins shall be corrosion-resistant steel. Screws and spring covers shall be cadmium-plated brass. Rubber or neoprene gaskets shall provide a positive seal against the weather.

2.4.4 Device Plates

Wall plates for flush snap switches and receptacles shall be the appropriate type and size and shall match the wiring devices for which they

are intended. Dimensions for openings in wall plates shall be in accordance with NEMA WD 1.

Wall plates for flush snap switches and receptacles shall be molded white-colored nylon. Mounting screws shall have oval countersunk heads finished to match the plate.

2.5 BOXES AND FITTINGS

Boxes shall have sufficient volume to accommodate the number of conductors entering the box in accordance with the requirements of NFPA 70 and UL 514A. Boxes that are exposed to the weather or that are in normally wet locations shall be cast-metal with threaded hubs. Surface-mounted boxes on interior walls shall be cast-metal. Boxes in other areas shall be cadmium-plated or zinc-coated sheet metal.

2.5.1 Sheet Metal Boxes and Outlets

Outlet, switch, and junction boxes flush-mounted in walls or ceilings shall be square-shaped gang boxes as appropriate, with extension rings and covers.

Ceiling outlet boxes, from which surface- and pendant-mounted lighting fixtures are supported, shall be not less than 4 inches square, with plaster rings 1-1/2 inches deep and shall be capable of withstanding a vertical downward force of 200 pounds for 5 minutes. All boxes in spaces above suspended ceilings shall be installed in accessible locations. Boxes in otherwise inaccessible locations shall be accessible from ceiling space access panels. Ceiling-mounted outlet boxes for lighting fixtures, fittings, and wiring devices shall be symmetrical, except as otherwise indicated, and shall not interfere with the work of other trades.

Wall outlet boxes for single-gang flush wiring devices shall be not less than 4 inches square and 1-1/2 inches deep. Wall outlet boxes for multiple-gang flush wiring devices shall be not less than 4-1/2 inches wide and 2-1/2 inches deep. Wall-mounted outlet boxes for lighting fixtures and flush devices shall be capable of withstanding a vertical downward force of 50 pounds for a period of 5 minutes.

Boxes shall be formed from carbon-steel sheets of commercial quality, not less than 14-gage. Boxes shall be one-piece construction, zinc- or cadmium-plated in accordance with UL 514A. Boxes and box extension rings shall be provided with knockouts. Boxes shall be designed for mounting flush wiring devices.

Exposed surface junction boxes shall be installed only in equipment rooms and other utility areas.

Surface-mounted boxes shall be outside flange type with a matching solid flat cover. Flush-mounted boxes in walls and floors shall be the outside flange type with a matching recessed solid walkway cover. Box bodies and covers shall be galvanized by the hot-dip process in accordance with ASTM A 123/A 123M, Class A.

2.5.2 Cast-Metal Boxes

Cast-metal pull and junction boxes having an internal unobstructed air space of more than 100 cubic inches for connection to galvanized rigid steel conduits embedded in concrete or surface mounted shall be watertight rectangular boxes in accordance with UL 50 and NEMA FB 1.

Box bodies and covers shall be cast or malleable iron with a wall thickness not less than 1/8 inch at every point, of greater thickness at reinforcing ribs and cover edges, and not less than 1/4 inch in thickness at tapped holes for rigid steel conduit. Box bodies shall be provided with integral threaded conduit openings, as required. Mounting lugs shall be provided at the back or at the bottom corner of the box body. Boxes shall be provided with neoprene cover gaskets that will prevent the entrance of water into the enclosure. Covers shall be secured to box bodies with AWG No. 6 or larger bronze flathead screws.

2.5.3 Pull and Junction Boxes

Pull and junction boxes shall be fabricated from carbon steel and shall conform to UL 50. Box dimensions and conduit connections shall conform to NFPA 70.

Boxes shall be welded construction with flat removable covers fastened to the box with machine screws. Seams and joints at corners or back edges of the box shall be closed and reinforced with flanges formed of the same material from which the box is constructed or by other means such as continuous welding which provides a construction equivalent to integral flange construction.

Boxes intended for outdoor use shall be hot-dipped galvanized with threaded hubs and neoprene-gasketed covers.

Boxes intended for use in dry locations shall be sheet steel [hot-dipped] galvanized after fabrication conforming to UL 514A.

PART 3 EXECUTION

3.1 INSTALLATION

Power, lighting, control emergency light and power, and special-service systems and all related components shall be installed in accordance with NFPA 70, and shall be enclosed in separate conduit or separate conduit systems.

Any run of EMT, intermediate, or rigid conduit between outlet and outlet, between fitting and fitting, or between outlet and fitting shall contain not more than the equivalent of three 90-degree bends, including those bends located immediately at the outlet or fitting. Field bends shall be made in accordance with the manufacturer's recommendations, which normally require use of a one-size-larger bender than would be required for uncoated conduit. Installed conduit and fittings shall be free of dirt and trash and shall not be deformed or crushed. Empty conduit shall have a pull rope stalled.

Conduit shall be installed with a minimum of 3 inches of free air space separation from mechanical piping.

Conduit in finished areas shall be installed concealed. Conduit passing through masonry or concrete walls shall be installed in sleeves.

Conduit shall be securely clamped and supported at least every 10 feet vertically and 8 feet horizontally from structure. Galvanized pipe straps shall be fastened to structure with bolts, screws, and anchors. Wooden masonry plugs shall not be used.

Conduit and boxes shall not be supported from T-bar ceiling wires.

All recessed outlet boxes in non-combustible walls or ceilings shall be installed flush, such that the outlet box is set back less than 1/16 inch or protrudes less than 1/16 inch from the face of the ceiling or wall.

Conduit connections to boxes and fittings shall be supported not more than 36 inches from the connection point. Conduit bends shall be supported not more than 36 inches from each change in direction. Conduit shall be installed in neat symmetrical lines parallel to the centerlines of the building construction and the building outline. Multiple runs shall be parallel and grouped whenever possible on common supports.

Conduit and raceway runs in or under concrete, in damp, corrosive, or outdoor locations, in hazardous areas, where subject to mechanical damage, or intended for conductors rated over 600 volts, shall be rigid steel conduit. Conduit joints in corrosive areas shall be painted with corrosion-inhibiting compounds.

Conduit and raceway runs concealed in or behind walls, above ceilings, or exposed on walls and ceilings 5 feet or more above finished floors and not subject to mechanical damage may be electrical metallic tubing (EMT).

Ends of conduit extending from the interior to the exterior of the building and portions of interior conduit exposed to widely varying temperatures shall be sealed to prevent the passage of air within the conduit. Conduit shall be sloped to drain and shall be provided with drainage fittings at the lower end of the run. Curved portion of conduit bends shall not be visible above the finished floor. Underground service entrance and feeder conduit entering or leaving the building above the ground floor shall be terminated in a pull box.

Expansion fittings with flexible ground strap shall be provided in conduit runs crossing building expansion joints.

Underground portions of conduit runs shall be painted with bitumastic or shall be provided with a factory-applied coating of PVC not less than 0.20 inch thick. Underground conduit encased in concrete does not require a protective coating of PVC. When the factory-applied coating is chosen by the Contractor, any nicks, cuts, or other abrasions shall be wrapped with a single layer of 0.010 inch thick pressure-sensitive PVC tape, half-lapped to obtain a minimum thickness of 0.20 inch. Couplings shall be wrapped with pressure-sensitive tape, as described above, over the coupling and for

2 inches on each side of the coupling. When precoated couplings designed for the purpose are used, taping may be omitted provided the manufacturer's adhesive is used between the coating on the coupling and the coating on the conduit. Depth of buried conduit shall be in accordance with NFPA 70 or as indicated on the contract drawings.

Exposed ends of conduit without conductors shall be sealed with watertight caps or plugs.

Bushings shall be provided on the open ends of conduit. Insulated bushings shall be provided for conduits containing conductors AWG No. 4 or larger with an insulating ring an integral part of the bushing.

Flexible metallic conduit shall be used to connect recessed fixtures from outlet boxes in ceilings, metallic transformers, and other approved assemblies. Sections of flexible steel conduit shall be not more than 6 feet long and shall be installed only in exposed or accessible locations. Interior surfaces of conduit shall be free from burrs and sharp edges which might cause abrasion of wire and cable coverings. Ends of flexible steel conduit shall be provided with grounding bushings and approved fittings.

Bonding wires shall be used in flexible conduit for all circuits. Flexible conduit shall not be considered a ground conductor.

Liquidtight flexible metallic conduits shall be used in wet and oily locations and to complete the connection to motor-driven equipment.

Electrical connections to vibration-isolated equipment shall be made with flexible metallic conduit in a manner that will not impair the function of the equipment.

Wire or cable shall not be installed in conduit until the conduit system is completed; the inner surfaces of conduit shall be clean and dry.

A nylon pull rope with a tensile strength not less than 130 pounds shall be installed in empty conduit.

3.1.1 Installation of Rigid Metal Conduit

Ends of conduit shall be cut square, reamed and threaded, and joints shall be brought butt-to-butt in the couplings. Joints shall be mechanically tight. Conduit shall be protected against damage and the entrance of water or foreign material during construction.

Ninety-degree bends of conduit with a diameter larger than 1 inch shall be made with factory-made elbows. Conduit elbows larger than 2-1/2 inches shall be long radius. Field-made bends and offsets shall be made with an approved hickey or conduit-bending machine. Changes in directions of runs shall be made with symmetrical bends or cast-metal fittings.

At connections to sheet metal enclosures and boxes, a sufficient number of threads shall project through to permit the bushing to be drawn tight against the end of the conduit, after which the locknut shall be pulled up sufficiently tight to draw the bushing into firm electrical contact with

the box. Conduit shall be fastened to sheet metal boxes and cabinets with two locknuts where required by NFPA 70 where insulating bushings are used, where bushings cannot be brought into firm contact with the box, and where indicated.

Conduit joints shall be made with tapered threads set firmly. Each length of conduit cut in the field shall be reamed before installation. Where conduit is threaded in the field, each threaded end shall consist of at least five full threads. Corrosion-inhibitive compound shall be used on conduit threads in exterior areas.

Conduit stubbed-up through concrete floors for connections to free-standing equipment except motor-control centers, cubicles, and other such items of equipment shall be provided with a flush coupling if the floor slab is of sufficient thickness; if not, a floor box shall be provided and set flush with the finished floor. Conduits installed for future use shall be terminated with a coupling and plug set flush with the floor.

3.1.2 Installation of Rigid PVC Conduit

Rigid PVC conduit for underground work shall be encased in a concrete envelope or direct buried as specified for underground ducts. Where suitable protection is provided, PVC can be run exposed particularly in high corrosion areas.

A continuous, insulated, soft-drawn copper ground wire shall be run in conduit with conductors and shall be solidly connected to ground at each end. Ground wires shall be sized in accordance with NFPA 70.

Rigid PVC conduit shall be stored on a flat surface and shall be protected from the direct rays of the sun.

3.1.3 Installation of EMT

EMT shall be cut square and reamed to remove burrs and rough surfaces.

Field-made bends and offsets shall be avoided where possible but, where necessary, shall be made with an approved hickey or conduit-bending machine. Changes in direction of runs shall be made with symmetrical bends or approved metal fittings.

3.1.4 Installation of Wireways and Auxiliary Gutters

Straight sections and fittings shall be bolted together to provide a rigid mechanical connection and electrical continuity. Dead ends of wireways and auxiliary gutters shall be closed. Unused conduit openings shall be plugged.

Wireways for overhead distribution and control circuits shall be supported at maximum 5-foot intervals.

Auxiliary gutters used to supplement wiring spaces for equipment not contained in a single enclosure shall not contain switches, overcurrent devices, appliances, or apparatus and shall be not more than 30 feet long.

3.1.5 Installation of Flexible Metallic Conduit

Flexible metallic conduit shall be installed only in exposed, accessible locations in accordance with NFPA 70. A grounding green conductor shall be installed in all runs. Connections to motors and vibrating equipment shall be made with flexible metallic conduit.

3.2 INSTALLATION OF WIRING

Raceways shall be completely installed, with interiors protected from the weather, before proceeding with the installation of wires and cables. Conductors of special-service systems and emergency light and power systems shall not occupy the same enclosure with light and power conductors or the same enclosure with each other. Conductors shall be continuous with splices and connections made in outlet, junction, or pull boxes only. All control wiring shall be continuous between components and/or terminal boards.

Phase conductors and the neutral conductor of each branch or feeder circuit shall be contained in a single enclosure or paralleled in separate enclosures to avoid overheating the raceway by electromagnetic induction. Conductors and conduit in parallel shall be the same length and size, shall have conductors of the same type of insulation, shall be terminated at both ends in a manner to ensure equal division of the total current among conductors, and shall have a separate neutral conductor in each conduit.

Sharing of a common neutral between single phase circuits, connected to different phases, shall not be permitted.

Conductors installed in heavy-wall rigid steel conduit and EMT shall have allowable current-carrying capacity and ampere ratings in accordance with NFPA 70. Larger-sized conductors shall be used to compensate for derating factors when more than three current-carrying conductors are installed in raceways and when conductors are installed in wet locations.

Conductors 600 volts and below shall be color coded in accordance with the following:

<u>CONDUCTOR</u>	<u>120/208</u> <u>COLOR</u>	<u>480/277</u> <u>COLOR</u>
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	White/Gray
Equipment Grounds	Green	Green

Conductors up to and including AWG No. 2 shall be manufactured with colored insulating materials. Conductors larger than AWG No. 2 shall have ends identified with colored plastic tape in outlet, pull, or junction boxes.

Control circuit conductors shall be identified at each connection point.

Connectors and splices shall conform to UL 486C and shall be made in approved enclosures utilizing solderless pressure connectors and adequate insulation with vinyl-plastic electrical insulating tape. Conductors and materials used in a splice, tap, or connection shall be thoroughly cleaned prior to makeup to ensure good electrical and mechanical connections. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made and at the equipment terminal of each conductor. Terminal and conductor identification shall match that shown on approved shop drawings. Hand lettering or marking is not acceptable. Control-circuit terminals of equipment shall be properly identified by color-coded insulated conductors, number-coded plastic self-sticking printed markers, or permanently attached metal-foil markers. Cable fittings shall conform to UL 514B; insulating tape shall conform to ASTM D 2301.

Where several feeders pass through a common pullbox, the feeders shall be tagged to clearly indicate the electrical characteristics, circuit number, and panel designation.

Grounding shall be provided in accordance with NFPA 70. Noncurrent-carrying parts of electrical equipment shall be bonded and grounded together.

3.3 SAFETY SWITCHES

Switches shall be securely fastened to the supporting structure or wall utilizing a minimum of four 1/4 inch bolts. Sheet metal screws and small machine screws shall not be used for mounting. Switches shall not be mounted in an inaccessible location or where the passageway to the switch may become obstructed. Mounting height shall be 5 feet above floor level, when possible.

3.4 WIRING DEVICES

3.4.1 Wall Switches and Receptacles

Wall switches and receptacles shall be so installed that when device plates are applied, the plates will be aligned vertically.

Ground terminal of each flush-mounted receptacle shall be bonded to the outlet box with an approved green bonding jumper.

3.4.2 Device Plates

Device plates for switches that are not within sight of the loads controlled shall be suitably engraved with a description of the loads.

Device plates and receptacle cover plates for receptacles other than 20-ampere, 125-volt, single-phase, duplex, convenience outlets shall be suitably engraved, showing the circuit number, voltage, frequency, phasing, and amperage available at the receptacle; for example: RP1-12, 208 VOLTS, 60 HERTZ, 3-PHASE, 30 AMPERES. If engraving is not practical, an engraved laminated phenolic identification plate may be applied.

Device plates shall be identified on the inside by circuit number and panelboard.

3.5 BOXES AND FITTINGS

Pullboxes shall be furnished and installed where necessary in the conduit system to facilitate conductor installation. Conduit runs longer than 100 feet or with more than three right-angle bends shall have a pullbox installed at a convenient intermediate location.

Boxes and enclosures shall be securely mounted to the building structure with supporting facilities independent of the conduit entering or leaving the boxes.

Bonding jumpers shall be used around concentric or eccentric knockouts.

Approximate mounting height of wall-mounted outlet and switch boxes, measured between the bottom of the box and the finished floor, shall be as follows:

<u>LOCATION</u>	<u>MOUNTING HEIGHT</u>
Receptacles in offices	18 inches
Receptacles in corridors	18 inches
Switches for light control	48 inches
Thermostats	66 inches

3.6 IDENTIFICATION PLATES

Red identification plates reading CAUTION: 480/277 VOLTS shall be provided in switch and outlet boxes containing 277- or 480-volt circuits. An identification plate marked DANGER: 480 VOLTS shall be provided on the outside of 480-volt enclosures. Identification plate shall use white lettering on a red laminated plastic.

Any equipment with externally powered wiring shall be marked with a laminated plaster nameplate having 3/16 inch high white letters on a red background as follows:

DANGER - EXTERNAL VOLTAGE SOURCE

3.7 FIELD TESTING

Test reports shall be submitted in accordance with referenced standards in this section.

After completion of the installation and splicing, and prior to energizing the conductors, wire and cable shall be given continuity and insulation tests as herein specified before the conductors are energized.

Necessary test equipment, labor, and personnel shall be provided by the Contractor to perform the tests, as herein specified. Continuity tests shall be conducted using a dc device with bell or buzzer.

Wire and cable in each voltage classification shall be completely isolated from all extraneous electrical connections at cable terminations and joints. Substation and switchboard feeder breakers, disconnects in combination motor starters, circuit breakers in panel boards, and other disconnecting devices shall be used to isolate the circuits under test.

Insulation tests on circuits rated 480-volts and less shall be conducted using a 500- or 1,000-volt insulation-resistance test set. Readings shall be taken every minute until three equal and consecutive readings are obtained. Resistance between phase conductors and between phase conductors and ground shall be not less than 25 megohms.

Insulation tests on circuits rated 240 volts or less, with conductor sizes 2 AWG and larger, shall be conducted using a 500- or 1,000-volt insulation-resistance test set. Readings shall be taken after 1 minute and until the reading is constant for 15 seconds. Resistance between phase conductors and between phase conductors and ground shall be not less than 25 megohms.

Phase-rotation tests shall be conducted on all three-phase circuits using a phase-rotation indicating instrument. Phase rotation of electrical connections to connected equipment shall be clockwise, facing the source.

Final acceptance will depend upon the successful performance of wire and cable under test. No conductor shall be energized until the installation is approved.

-- End of Section --

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SECTION 16225

MOTORS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 11 (1990; R 2000) Load Ratings and Fatigue Life for Roller Bearings

ABMA 9 (1990; R 2000) Load Ratings and Fatigue Life for Ball Bearings

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE Std 112 (1996) Standard Test Procedure for Polyphase Induction Motors and Generators

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS (2003) Acceptance Testing Specifications for Electrical Power Distribution Equipment Systems

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 1940-1 (2003) Mechanical Vibration - Balance Quality Requirements of Rigid Rotors - Part 1: Determination of Permissible Residual Unbalance

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

NEMA MG 1 (2002) Motors and Generators

U.S. DEPARTMENT OF ENERGY (DOE)

DOE CI-1 (2001) How to Buy a Premium Energy-Efficient Electric Motor

1.2 GENERAL REQUIREMENTS

Section 16003 GENERAL ELECTRICAL PROVISIONS applies to work specified in this section.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Outline drawings for Motors shall indicate overall physical features, dimensions, ratings, service requirements, and weights of equipment.

SD-03 Product Data

Equipment and performance data shall be submitted for Motors consisting of use life, system functional flows, safety features, and mechanical automated details. Curves indicating tested and certified equipment response and performance characteristics shall also be submitted.

Submit Manufacturer's Catalog Data in accordance with paragraph entitled, "Equipment," of this section

For Electric Motors rated over 7.5 hp and those specified to meet a special vibration class in accordance with NEMA MG 1 indicate number of:

Rotor Bars
Stator Slots
Rotational Speed
Cooling Fan Blades
Bearing Manufacturer
Bearing Style
Bearing Type
Balls/Elements
Commutator Bars
Commutator Brushes
SCR Firing Frequencies (for variable speed motors)

SD-07 Certificates

Certificates shall be submitted for the following tests showing conformance with the referenced standards contained in this section. Certified copies of previous test reports on identical motors may be submitted in lieu of factory test reports.

Factory Test Results
Efficiency
Power-Factor
Service Factor
Temperature Rating
Noise
Full-Load
Locked-Rotor
Insulation Resistance

Winding Resistance
High-Potential Tests

SD-08 Manufacturer's Instructions

Manufacturer's Instructions shall be submitted for Motors including special provisions required to install equipment components and system packages. Special notices shall detail impedances, hazards and safety precautions.

1.4 DESIGN REQUIREMENTS

The following motor design data shall be provided prior to final turnover-number of motor rotor bars, Stator slots, rotational speed; number of cooling fan blades; RPM of motor; bearing manufacturer, bearing type, bearing style and number of balls/elements; number of commutator bars and commutator brushes; and SCR firing frequencies.

PART 2 PRODUCTS

2.1 EQUIPMENT

Submit manufacturer's catalog data for motors and enclosures.

Design, fabrication, testing, and performance of motors shall be in accordance with NEMA MG 1 and ISO 1940-1 and shall meet or exceed the requirements as specified herein.

Testing and performance of polyphase induction motors shall be in accordance with IEEE Std 112, Method B.

Efficiency labeling shall be in accordance with NEMA MG 1.

Allowable balance limits shall be in accordance with ISO 1940-1, Table 1

2.1.1 Efficiency

Motors shall have efficiencies in accordance with the recommended levels specified in DOE CI-1.

2.2 MOTOR TYPES

Motor shall be marked to show the index letter, which shall be the letter shown or a letter that indicates a higher efficiency.

Motors shall be of the following types:

1/2 HP and smaller, single phase - capacitor start

3/4 HP and larger, three-phase - induction squirrel-cage type, NEMA Design B, having normal starting torque and low starting current

Motors shall be designed for across-the-line starting and shall be designed with torque characteristics to carry the specified rated starting load.

Motors shall have factory-sealed ball bearings with an L-10 rated life of not less than 50,000 hours in accordance with ABMA 9 or ABMA 11.

2.3 SIZES OF MOTORS

2.3.1 Motors

Motors shall be of a sufficient size for the duty to be performed and shall not exceed the full-load rating when the driven equipment is operating at specified capacity under the most severe loading conditions.

2.3.2 Electrically Driven Equipment

When electrically driven equipment differs from that indicated, adjustments shall be made to the motor size, wiring and conduit systems, disconnect devices, and circuit protection to accommodate the equipment actually installed, at no additional cost to the Government. Control and protective devices shall be in accordance with Section 16286 OVERCURRENT PROTECTIVE DEVICES."

2.4 VOLTAGE RATINGS

Motors shall have the following minimum voltage ratings:

MOTOR SIZE		MOTOR	
<u>MOTOR TYPE</u>	<u>HORSEPOWER</u>	<u>SERVICE</u>	<u>VOLTAGE RATING</u>
Fractional horsepower, single-phase	1/2 and smaller	120/208-volt, 3-phase, 4-wire	115-volt, 60-hertz
Fractional and integral horsepower, 3-phase	3/4 and larger	120/208-volt, 3-phase, 4-wire	200-volt, 3-phase 60-hertz

2.5 TEMPERATURE RATING AND INSULATION

Motors shall be designed for continuous operation at the rated full load in an ambient temperature of 104 degrees F.

Insulation level shall be at least Class F.

2.6 MOTOR HOUSINGS

The motor housing shall have a smooth surface in the vertical, horizontal, and axial directions at each bearing housing for attaching a magnet mounted accelerometer in order to monitor the motor vibration. The surface shall be on the bearing housing. The axial surface will be as close to the motor centerline as possible. The surface will have a finish

of 63 micro-inch minimum. Diameter of finished surface shall be 2 inch minimum and must be corrosion resistant. As an option sound disks can be used to meet the smooth surface requirement. Disk shall have a minimum thickness of 3/8 inch.

Surface shall be level within 1 degree or .001 inch.

The smooth surface shall be identified(using a label or plate) "Vibration data collection point - Do Not Paint"

2.7 MOTOR ENCLOSURES

Motors installed in indoor, clean, dry, nonhazardous locations shall have open-type drip-proof enclosures. Enclosures shall have a hinged access cover at each vibration collection point. Cover must be large enough to enable the placement of a magnet/accelerometer data collection instrument.

Motors installed in indoor, wet, nonhazardous locations shall have open splash-proof enclosures. Enclosures shall have a hinged access cover at each vibration collection point. Cover must be large enough to enable the placement of a magnet/accelerometer data collection instrument.

Motors installed in indoor, nonhazardous locations where it is necessary to protect the motor from dirt, moisture, chemical fumes, or other harmful ingredients in the surrounding atmosphere shall be the totally enclosed type, with either of the following:

Totally enclosed, not fan-cooled, enclosures not equipped for cooling by means external to the enclosing parts. Enclosures shall have a hinged access cover at each vibration collection point. Cover must be large enough to enable the placement of a magnet/accelerometer data collection instrument.

Totally enclosed fan-cooled enclosures for exterior cooling by means of a fan or fans integral with the machine but external to the enclosing parts. Enclosures shall have a hinged access cover at each vibration collection point. Cover must be large enough to enable the placement of a magnet/accelerometer data collection instrument.

Motors installed in outdoor, nonhazardous locations shall have waterproof enclosures.

Motors installed in hazardous locations for Classification I, Division 1 or Division 2 shall meet or exceed the minimum requirements of NFPA 70, Article 501.8. Type of enclosure shall be approved by the Contracting Officer prior to fabrication for the class and group of hazard in which the motors are located.

Motors with weatherproof/waterproof enclosures shall have permanent accelerometers installed in the horizontal, vertical, and axial directions.

The enclosure shall have a penetration installed to enable the accelerometer cables to be routed to outside the enclosure. A data collection box shall be mounted to the outside of the motor enclosure in a

location that is easily accessible. Data collection box shall be rated NEMA 4R.

2.8 SERVICE FACTOR

Service factor of general purpose and other open ac motors shall be in accordance with NEMA MG 1.

Totally enclosed ac motors shall have a service factor of 1.15.

2.9 FACTORY TESTS

Factory test all motors in accordance with the requirements of NEMA MG 1. Polyphase induction motors shall be factory-tested in accordance with IEEE Std 112, Method B. Tests shall consist of measurements of voltage, frequency, speed, and current under no-load conditions; voltage, frequency, and current under locked-rotor conditions; and efficiency, noise, power factor, and thermal protection. Routine tests on wound-rotor induction motors shall include the measurement of wound-rotor open-circuit voltage across the slip rings under locked-rotor conditions. Electrical tests shall consist of winding resistance, insulation resistance, and high-potential tests. Submit certified copies of factory test results for approval prior to shipment from the factory. Previous test reports on identical motors are not acceptable for these tests.

PART 3 EXECUTION

3.1 INSTALLATION

Motors shall be installed, aligned, and connected in accordance with the equipment manufacturer's instructions.

Motors shall be bolt mounted. Motor feet shall be coplanar within 0.001 inch.

Base mounting points shall be accessible and adjustable to enable machine alignment. Motors over 7.5 hp shall have alignment jack bolts installed to enable alignment.

Alignment of motors shall be rechecked and adjusted as required after the motor has been in operation for not less than 48 hours.

3.2 ALIGNMENT

Before attempting alignment, the contractor will demonstrate that the load does not have any load/force imposed by the piping system. Minimum alignment values (below) are for motor and load at normal running temperatures. Values must be compensated for thermal growth. Limited movement of the motor or load (commonly known as bolt-bound) must be corrected to ensure alignment capability. Hold down bolts shall not be undercut in order to perform adjustment.

Shims shall be commercially die-cut, without seams or folds, and be made of corrosion resistant stainless steel. No more than four shims shall be used at any single point.

Motor and load shall be aligned to the following minimum specifications:

Speed(RPM)	Close-Coupled Offset (mils)	Close-Coupled Angle(mils/in.)	Spool Piece Angle (mils/in. @ coupling pt.)
600	6.0	2.0	3.0
900	5.0	1.5	2.0
1200	4.0	1.0	1.5
1800	3.0	0.5	1.0
3600	1.5	0.4	0.5
7200	1.0	0.3	0.4

Motor/load alignment shall be performed under the direction of the manufacturer's representative.

Final alignment settings shall be provided as part of the final test data.

3.3 ELECTRICAL TESTS

Perform continuity test on all phases.

Perform insulation resistance and polarization index test on each phase of motor. Insulation tests on motors rated less than 480-volts shall be conducted using 500-volt insulation test set.

Test data shall include the location and identification of motors and megohm readings versus time. Test data shall be recorded at 15, 30, 45 seconds, and in 1 minute increments thereafter up to 10 minutes. Megohm readings shall not be less than 25 megohms for each phase and each phase reading shall be within 10 percent of the other two.

Perform inspections and test procedures on all motors in accordance with NETA ATS 7.15.1 for rotating machinery, AC motors.

Calculate the polarization index of each phase by dividing the 10 minute reading by the 1 minute reading. The polarization index shall be greater than 1.25. Any values lower shall be rejected and the motor returned to the factory.

3.4 VIBRATION TESTS

3.4.1 Vibration Analyzer

Contractor shall use a Fast Fourier Transformer (FFT) analyzer to measure vibration levels. It shall have the following characteristics: A dynamic range greater than 70 dB; a minimum of 400 line resolution; a frequency response range of 5 Hz-10 KHz(300-600000 cpm); the capacity to perform ensemble averaging, the capability to use a Hanning window; auto-ranging frequency amplitude; a minimum amplitude accuracy over the selected frequency range of plus or minus 20 percent or plus or minus 1.5 dB.

An accelerometer, either stud-mounted or mounted using a rare earth, low mass magnet and sound disk(or finished surface) shall be used with the FFT analyzer to collect data. The mass of the accelerometer and its mounting

shall have minimal influence on the frequency response of the system over the selected measurement range.

3.4.2 Vibration Data

Vibration data shall be collected in the axial, vertical, and horizontal direction for each motor bearing.

Two narrowband spectra for each data collection point shall be obtained in the following manner: For all machines regardless of operating speed, a 5 to 500 Hz spectrum with a minimum of 400 lines of resolution shall be obtained. An additional spectrum of 5 to 2500 or 5 to 5000 Hz shall be acquired for machines operating at or below 1800 RPM or greater than 1800 RPM, respectively.

Vibration limits shall conform to the following:

<u>Frequency Range(CPM)</u>	<u>Vibration limit(inch/sec)</u>
0.3xRPM to 0.8xRPM	0.04
0.8xRPM to 1.2xRPM	0.75
1.2xRPM to 3.5xRPM	0.04
3.5xRPM to 120,000cpm	0.03

Final test reports shall be provided to the Contracting Officer. Reports shall have a cover letter/sheet clearly marked with the System name, Date, and the words "Final Test Reports - Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database."

-- End of Section --

SECTION 16275

DISTRIBUTION TRANSFORMERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- | | |
|----------------|---|
| IEEE C57.12.90 | (1999) Standard Test Code for
Liquid-Immersed Distribution, Power, and
Regulating Transformers |
| IEEE Std 62 | ((1995) Guide for Diagnostic Field Testing
of Electric Power Apparatus-Part 1: Oil
Filled Power Transformers, Regulators, and
Reactors |

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- | | |
|-----------|--|
| NEMA ST 1 | (1988) Specialty Transformers (Except
General Purpose Type) |
|-----------|--|

UNDERWRITERS LABORATORIES (UL)

- | | |
|--------|---|
| UL 506 | (2004) UL Standard for Safety Specialty
Transformers |
|--------|---|

1.2 GENERAL REQUIREMENTS

Section 16003 GENERAL ELECTRICAL PROVISIONS applies to work specified in this section.

Certification of previous tests on similar units under actual conditions may be submitted for impulse tests, temperature rise tests, sound tests, power-factor tests, bushing tests, and short-circuit tests in lieu of factory tests on actual units furnished.

Equipment and performance data shall be submitted for distribution transformers including resistance measurements, impedance, efficiencies and voltage and load losses at rated currents.

Equipment foundation data for distribution transformers shall include plan dimensions of foundations and relative elevations, equipment weight and operating loads, horizontal and vertical loads, horizontal and vertical clearances for installation, and size and location of anchor bolts.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTALS PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

The following shall be submitted for distribution transformers:

Connection Diagrams
Fabrication Drawings
Installation Drawings

SD-03 Product Data

Equipment and Performance data and Equipment Foundation Data shall be submitted for distribution transformers.

Manufacturer's catalog data shall be submitted for the following items:

Dry-Type Distribution Transformers

SD-06 Test Reports

Test reports shall be submitted for the following tests on distribution transformers in accordance with the paragraph entitled, "Field Testing," of this section.

Power Factor Tests
Insulation Resistance Tests
Insulation Power Factor (Doble) Tests

SD-07 Certificates

Certification of previous tests on similar units (type-testing) under actual conditions may be submitted for impulse tests, efficiencies, temperature-rise tests, sound tests, power-factor tests, bushing tests, and short-circuit tests in lieu of factory tests on actual units furnished.

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be submitted for the following equipment:

Dry-Type Distribution Transformers
Pad-Mounted Liquid-Filled Distribution Transformers

1.4 FACTORY TESTING

Tests on transformers shall comprise the manufacturer's standard tests including resistance measurements of all windings; ratio tests; polarity

and phase-relation tests; no-load loss at rated voltage; impedance; voltage and load loss at rated current; insulation power factor (Doble) tests, insulation oil tests, and dielectric tests. For oil-filled units manufacturer shall certify that the oil contains no PCB's and shall affix a label to that effect on the transformer tank and on each oil drum containing the insulating oil.

1.5 DRAWINGS

Connection diagrams shall be submitted for distribution transformers indicating the relations and connections of devices and apparatus by showing the general physical layout of all controls, the interconnection of one system or portion of system with another, and internal tubing, wiring, and other devices.

Fabrication drawings shall be submitted for distribution transformers consisting of fabrication and assembly details to be performed in the factory.

Installation drawings shall be submitted for distribution transformers in accordance with the paragraph entitled, "Installation," of this section.

PART 2 PRODUCTS

2.1 EQUIPMENT STANDARDS

2.1.1 Dry-Type Distribution Transformers

General-purpose dry-type transformers for connection to low-voltage distribution circuits of 600 volts or less and the supply of current for lighting and power loads shall be two-winding, 60-hertz, self-contained, self-cooled, Class AA in accordance with NEMA ST 1 and UL 506.

Insulation system limiting temperature shall be in accordance with the following table, with a temperature rise of:

<u>Dry-Type</u> <u>Class</u>	<u>Maximum Rise</u> <u>by Resistance</u>	<u>Reference</u> <u>Temperature</u>
H	150 degrees C	180 degrees C

2.2 FACTORY FINISH

Transformers shall be provided with the manufacturer's standard paint finish in Malmstrom Air Force Base standard color when used for most indoor installations. For harsh indoor environments (any area subjected to chemical and/or abrasive action), refer to Section 09960 HIGH PERFORMANCE COATINGS.

PART 3 EXECUTION

3.1 INSTALLATION

Dry type transformers shall be installed on resilient vibration-isolating

mountings and connected with flexible metallic conduit to prevent transmission and amplification of sound.

3.2 FIELD TESTING

Transformers shall be tested in accordance with IEEE Std 62 by manufacturer and certification of tests provided with shop drawing submittal.

3.2.1 Insulation-Resistance Tests

Transformer windings shall be given an insulation-resistance test using the following test set versus voltage level criteria:

Dry type 480- to 600-volt transformers - 1,000-volt test set

Dry type 240-volt and below transformers - 500-volt test set

Readings shall be recorded every 15 seconds for the first minute and every minute thereafter for 10 minutes. Resistance between phase conductors and ground shall be no less than the following:

Dry type 5 to 15 KV - 1000 megohms

Dry type 600 volt to 5 KV - 500 megohms

Dry type below 600 volts - 200 megohms

3.2.2 Insulation Power Factor (Doble) Tests

Transformer windings shall be given an insulation power factor test and winding excitation test in accordance with ANSI IEEE C57.12.90. New dry type units can have power factors up to 5.0 percent and still be acceptable.

3.2.3 Acceptance

Final acceptance shall depend upon the successful performance of the equipment under test. Transformers shall not be energized until recorded test data have been approved by the Contracting Officer. Final test reports shall be provided to the Contracting Officer. Reports shall have a cover letter/sheet clearly marked with the System name, Date, and the words "Final Test Reports - Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database."

-- End of Section --

SECTION 16286

OVERCURRENT PROTECTIVE DEVICES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|-------------|---|
| ANSI C37.09 | (1979) IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on Symmetrical Current Basis. |
| ANSI C63.2 | (1996) Standard for Instrumentation - Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz - Specifications |
| ANSI C63.4 | (2004) Methods of Measurement of Radio - Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz |
| ANSI C78.23 | (1995) Electric Lamps - Incandescent Lamps-Miscellaneous Types |

ASTM INTERNATIONAL (ASTM)

- | | |
|------------|--|
| ASTM A 167 | (1999) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip |
| ASTM D 877 | (2002) Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes |

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- | | |
|-------------|--|
| IEEE C12.1 | (2001) Code for Electricity Metering |
| IEEE C57.13 | (1993) Standard Requirements for Instrument Transformers |

IPI - ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES (IPC)

- | | |
|----------|-----------------|
| IPC D330 | (1992) Switches |
|----------|-----------------|

JOINT INDUSTRIAL COUNCIL (JIC)

JIC-01 (1967) Electrical Standards for Mass
Production Equipment

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 107 (1987; R 1993) Methods of Measurement of
Radio Influence Voltage (RIV) of
High-Voltage Apparatus

NEMA 250 (2003) Enclosures for Electric Equipment
(1000 Volts Maximum)

NEMA AB 1 (1999) Molded Case Circuit Breakers and
Molded Case Switches

NEMA AB 3 (2001) Molded Case Circuit Breakers and
Their Application

NEMA FU 1 (2002) Low Voltage Cartridge Fuses

NEMA ICS 1 (2000) Industrial Control and Systems:
General Requirements

NEMA ICS 2 (2000) Industrial Control Devices and
Assemblies

NEMA ICS 3 (1993; R 2000) Industrial Control and
Systems Factory Built Assemblies

NEMA ICS 6 (1993) Enclosures for Industrial Control
and Systems

NEMA SG 2 (1993) High-Voltage Fuses

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 489 (2003; Bulletin Feb 11, 1992; Bulletin Mar
16, 1992) UL Standard for Safety
Molded-Case Circuit Breakers and
Circuit-Breaker Enclosures

UL 50 (2003) UL Standard for Safety - Enclosures
for Electrical Equipment

UL 508 (2003) UL Standard for Safety Industrial
Control Equipment

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

No change in continuous-current rating, interrupting rating, and clearing or melting time of fuses shall be made unless written permission has first been secured from the Contracting Officer.

SD-02 Shop Drawings

Connection Diagrams and Fabrication Drawings shall be submitted for the following items in accordance with paragraph entitled, "General Requirements," of this section.

Installation drawings shall also be submitted for the following items in accordance with the paragraph entitled, "Installation," of this section.

Control Devices
Protective Devices

SD-03 Product Data

Equipment and performance data shall be submitted for the following items including use life, system functional flows, safety features, and mechanical automated details.

Manufacturer's catalog data shall also be submitted for the following items:

Motor Control
Instrument Transformers
Enclosures
Circuit Breakers
Fuses
Control Devices
Time Switches
Protective Relays
Indicating Instruments
Indicating Lights

SD-06 Test Reports

Factory Test Reports shall be submitted for Power, High Voltage, and Oil Circuit Breakers in accordance with ANSI C37.09.

Dielectric Tests

Timing Test
Insulation Power Factor Test

SD-07 Certificates

Certificates shall be submitted for Circuit Tests on similar motor-control or motor-circuit protector (MCP) units under actual conditions may be submitted in lieu of factory tests on the actual units provided.

SD-08 Manufacturer's Instructions

Manufacturer's Instructions shall be submitted for the following items, including special provisions required to install equipment components and system packages. Special notices shall detail, resistance impedances, hazards and safety precautions.

Control Devices
Protective Devices

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be submitted for the following equipment:

Manual Motor Controllers
Magnetic Motor Controllers
Combination Motor Controllers
High Voltage Motor Controllers
Circuit Breakers
Time Switches
Protective Relays
Indicating Instruments

1.3 GENERAL REQUIREMENTS

Section 16003 GENERAL ELECTRICAL PROVISIONS applies to work specified in this section.

Connection Diagrams shall be submitted showing the relations and connections of control devices and protective devices by showing the general physical layout of all controls, the interconnection of one system (or portion of system) with another, and internal tubing, wiring, and other devices.

Fabrication Drawings shall be submitted for control devices and protective devices consisting of fabrication and assembly details to be performed in the factory.

PART 2 PRODUCTS

2.1 MOTOR CONTROL

Motor controllers shall conform to NEMA ICS 1, NEMA ICS 2, and UL 508. Controllers shall have thermal overload protection in each phase.

2.1.1 Manual Motor Controllers

Manual motor controllers for the control and protection of single-phase 60-hertz ac fractional-horsepower squirrel-cage induction motors shall be full-voltage, manually operated devices.

Controllers shall be single-throw, single- or double-pole, three-position devices rated not more than 1 horsepower at 115- and 230-volts single phase. Controller shall include a supporting base or body of electrical insulating material with enclosed switching mechanism, yoke, thermal overload relay, and terminal connectors. Controllers shall clearly indicate operating condition: on, off, or tripped.

Manual motor controllers shall be the toggle- or key-operated type as indicated and shall be arranged so that they may be locked with a padlock in the "OFF" position.

Recessed manual motor controllers for single-speed, fractional-horsepower squirrel-cage induction motors shall include a single controller and indicating light in a 4-inch square wall outlet box for flush-wiring devices with matching corrosion-resistant steel flush cover plate. Surface-mounted manual motor controllers for single-speed, fractional-horsepower squirrel cage induction motors shall include a single controller and indicating light in a NEMA 250, Type 1 general-purpose enclosure.

Recessed and surface-mounted manual motor controllers for two-speed, fractional-horsepower squirrel-cage induction motors shall include two controllers, two indicating lights, and a selector switch in a multiple-gang wall outlet box for flush-wiring devices with matching corrosion-resistant steel flush-cover plate. Surface-mounted manual motor controllers for two-speed fractional-horsepower squirrel-cage induction motors shall include two controllers, two indicating lights, and a selector switch in a NEMA 250, Type 1 general-purpose enclosure.

2.1.2 Magnetic Motor Controllers

2.1.2.1 Full-Voltage Controllers

Magnetic motor controllers for the control and protection of single- and three-phase, 60-hertz, squirrel-cage induction motors shall be full-voltage, full magnetic devices in accordance with NEMA ICS 1, NEMA ICS 2, and UL 508.

Operating coil assembly shall operate satisfactorily between 85 and 110 percent of rated coil voltage. Motor control circuits shall be 120 volts, 60 hertz.

Controller shall be provided with two normally open and two normally closed auxiliary contacts rated per NEMA ICS 1 and NEMA ICS 2 in addition to the sealing-in contact for control circuits.

Solderless pressure wire terminal connectors shall be provided for line-and load-connections to controllers.

Overcurrent protection shall include three manual reset thermal overload devices, one in each pole of the controller. Thermal overload relays shall be [melting-alloy] [bimetallic nonadjustable] type with continuous current ratings and service-limit current ratings and shall have a plus or minus 15 percent adjustment to compensate for ambient operating conditions.

An externally operable manual-reset button shall be provided to re-establish control power to the holding coil of the electromagnet. After the controller has tripped from overload, resetting the motor-overload device shall not restart the motor.

Enclosure shall be in accordance with NEMA 250, Type 3R.

2.1.3 Combination Motor Controllers

Following requirements are in addition to the requirements specified for magnetic motor controller:

Combination motor controllers for the control and protection of single-and three-phase 60-hertz alternating-current squirrel-cage induction motors with branch-circuit disconnecting and protective devices shall be in accordance with NEMA ICS 1, NEMA ICS 2, and JIC-01.

Combination motor controllers shall include magnetic motor controllers and molded-case circuit breakers or MCP in metal enclosures in accordance with NEMA 250 or motor-control center draw-out assemblies with control-power transformers, selector switches, pushbuttons, and indicating lights as follows:

Magnetic motor controllers and enclosures shall be full-voltage, full-magnetic devices as specified in this section under paragraph entitled, "Remote-Control Station Enclosures."

Molded-case circuit breakers shall be thermal-magnetic breakers as specified in paragraph entitled, "Manual Motor Controllers." Manufacturer's standard MCP may be used in lieu of molded-case circuit breakers.

Control-power transformers 120-volt ac maximum selector switches, pushbuttons, and pilot lights shall be as required.

Combination motor controllers shall be identified with identification plates affixed to front cover of the controller.

2.1.3.1 Nonreversing Combination Motor Controllers

Following requirements are in addition to the requirements for magnetic motor controllers:

Nonreversing combination motor controllers for the control and protection of single-speed squirrel-cage induction motors shall include a magnetic controller with molded-case circuit breaker or MCP with selector switch or start/stop pushbutton and indicating light in the

cover of the enclosure.

Rating of [single] [and] [three]-phase single-speed full-voltage magnetic controllers for nonplugging and nonjogging duty shall be in accordance with NEMA ICS 1 and NEMA ICS 2.

Wiring and connections for full-voltage single-speed magnetic controllers shall be in accordance with NEMA ICS 1 and NEMA ICS 2.

2.1.3.2 Two-Speed Combination Motor Controllers

Following requirements are in addition to the requirements for magnetic motor controllers:

Two-speed combination motor controllers for the control and protection of single- and two-winding, two-speed, three-phase, squirrel-cage induction motors shall include two magnetic controllers with molded-case circuit breaker or MCP, with selector switch or fast/slow/stop pushbutton and two indicating lights in the cover of the enclosure. Indicating lights shall indicate the high- and low-speed running connection of the motor controller.

Rating of three-phase, two-speed, full-voltage, magnetic controllers for nonplugging and nonjogging duty for constant- and variable-torque motors shall be in accordance with NEMA ICS 1 and NEMA ICS 2.

Rating of three-phase, two-speed, full-voltage, magnetic controllers for nonplugging and nonjogging duty for constant-horsepower motors shall be in accordance with NEMA ICS 1 and NEMA ICS 2.

Rating of three-phase, two-speed, full-voltage, magnetic controllers for plug-stop, plug-reverse, or jogging duty for constant-torque, variable-torque, and constant horsepower motors shall be in accordance with NEMA ICS 1 and NEMA ICS 2.

2.2 INSTRUMENT TRANSFORMERS

Instrument transformers shall comply with the interference requirements listed below, measured in accordance with ANSI C63.2, ANSI C63.4, and NEMA 107.

Insulation Class, kV	Basic Insulation Level, kV	Preferred Nominal System Voltage, kV	Test Voltage for Potential Transformers, kV	Test Voltage for Current Transformers, kV	Radio Influence Voltage Level, <u>Microvolts</u>	
					Dry Type	Oil Filled
0.6	10	0.76	250	250
1.2	30	0.208	0.132	0.76	250	250
		0.416	0.264			
		0.832	0.528			
		1.04	0.66			

Insulation Class, kV	Basic Insulation Level, kV	Preferred Nominal System Voltage, kV	Test Voltage for Potential Transformers, kV	Test Voltage for Current Transformers, kV	Radio Influence Voltage Level, <u>Microvolts</u>	
					Dry Type	Oil Filled
2.5	45	2.40	1.52	1.67	250	250
5.0	60	4.16 4.80	2.64 3.04	3.34	250	250
8.7	75	7.20 8.32	4.57 5.28	5.77	250	250
15L or 15H	95-110	12.00 12.47 14.40	7.62 7.92 9.14	9.41	1000	250

2.2.1 Current Transformers

Current transformers shall conform to IEEE C57.13 for installation in metal-clad switchgear. Standard 3-A secondary transformer shall be used.

Transformers shall be window type.

Transformers shall have single secondary winding.

Transformers shall be complete with secondary short-circuiting device.

Window-type current transformers shall be indoor dry type construction with secondary current ratings as indicated. Burden, frequency, and accuracy shall be as specified.

2.2.2 Potential Transformers

Potential transformers shall conform to IEEE C57.13 for installation in metal-clad switchgear. Standard 120-volt secondary transformers shall be used.

Transformers shall have tapped secondary.

Burden, frequency, and accuracy shall be as required.

Disconnecting potential transformers with integral fuse mountings and current-limiting fuses shall be indoor dry type two-winding construction with primary and secondary voltage ratings as required.

2.3 ENCLOSURES

2.3.1 Equipment Enclosures

Enclosures for equipment shall be in accordance with NEMA 250.

Equipment installed inside, clean, dry locations shall be contained in NEMA Type 1, general-purpose sheet-steel enclosures.

Equipment installed in wet locations shall be contained in NEMA Type 4 watertight, corrosion-resistant sheet-steel enclosures, constructed to prevent entrance of water when tested in accordance with NEMA ICS 6 for Type 4 enclosures.

Equipment installed in industrial locations shall be contained in NEMA Type 12 industrial use, sheet-steel enclosures constructed to prevent the entrance of dust, lint, fibers, flyings, oil, and coolant seepage.

Equipment installed in Class I, Division I, Group A, B, C, and D, hazardous locations shall be contained in NEMA Type 7 enclosures approved for the specific flammable gas or vapor which is or may be present under normal operating conditions.

Equipment installed in Class II, Division I, Group E, F and G, hazardous locations shall be contained in NEMA Type 9 enclosures approved for use where combustible dust is or may be present under normal operating conditions.

Steel enclosures shall be fabricated from corrosion-resistant, chromium-nickel steel sheet conforming to ASTM A 167 Type 300 series with ASM No. 4 general-purpose polished finish. Box dimensions and thickness of sheet steel shall be in accordance with UL 50.

2.3.2 Remote-Control Station Enclosures

Remote-control station enclosures for pushbuttons, selector switches, and indicating lights shall be in accordance with the appropriate articles of NEMA ICS 6 and NEMA 250.

Remote-control stations installed in indoor, clean, dry locations shall be contained in NEMA Type 1 general-purpose, sheet-steel enclosures. Recessed remote-control stations shall be contained in standard wall outlet boxes with matching corrosion-resistant steel flush cover plate.

Remote-control stations installed in wet locations shall be contained in NEMA Type 4 watertight, corrosion-resistant sheet-steel enclosures constructed to prevent entrance of water when tested in accordance with NEMA ICS 6 and NEMA 250 for Type 4 enclosures.

Remote-control stations installed in industrial locations shall be contained in NEMA Type 12 industrial-use, sheet-steel enclosures constructed to prevent the entrance of dust, lint, fibers, flyings, oil, and coolant seepage.

Remote-control stations installed in industrial locations shall be contained in NEMA Type 12 industrial-use, cast-iron enclosures constructed to prevent the entrance of dust, lint, fibers, flyings, oil, and coolant seepage.

Remote-control stations installed in Class I, Division I, Group A, B, C,

and D, hazardous locations shall be contained in NEMA Type 7 enclosures approved for the specific flammable gas or vapor which is or may be present under normal operating conditions.

Remote-control stations installed in Class II, Division I, Group E, F and G, hazardous locations shall be contained in NEMA Type 9 enclosures approved for use where combustible dust is or may be present under normal operating conditions.

Steel enclosures shall be fabricated from corrosion-resistant, chromium-nickel steel sheet conforming to ASTM A 167, Type 300 series with ASM No. 4 general-purpose polished finish. Box dimensions and thickness of sheet steel shall be in accordance with UL 50.

Remote-control stations shall be installed with the centerline 66 inches above the finished floor.

2.4 CIRCUIT BREAKERS

Circuit breakers shall conform to UL 489, NEMA AB 1, and NEMA AB 3.

2.4.1 Molded-Case Circuit Breakers

Circuit breakers shall be molded case, manually operated, trip-free, with inverse-time thermal-overload protection and instantaneous magnetic short-circuit protection as required. Circuit breakers shall be completely enclosed in a molded case, with the calibrated sensing element factory-sealed to prevent tampering.

Thermal-magnetic tripping elements shall be located in each pole of the circuit breaker and shall provide inverse-time-delay thermal overload protection and instantaneous magnetic short-circuit protection. Instantaneous magnetic tripping element shall be adjustable and accessible from the front of the breaker on frame sizes larger than 100 amperes.

Breaker size shall be as required for the continuous current rating of the circuit. Breaker class shall be as required.

Interrupting capacity of the panel and lighting branch circuit breakers shall be sufficient to successfully interrupt the maximum short-circuit current imposed on the circuit at the breaker terminals. Circuit breaker interrupting capacities shall be a minimum of 10,000 amperes and shall conform to NEMA AB 3.

Multipole circuit breakers shall be of the common-trip type having a single operating handle and shall have two-position on/off indication. Circuit breakers shall have temperature compensation for operation in an ambient temperature of 104 degrees F. Circuit breakers shall have root mean square (rms) symmetrical interrupting ratings sufficient to protect the circuit being supplied. Interrupting ratings may have selective type tripping (time delay, magnetic, thermal, or ground fault).

Breaker body shall be of phenolic composition. Breakers shall be capable of having such accessories as handle-extension, handle-locking, and

padlocking devices attached where required.

Circuit breakers used for motor-circuit disconnects shall meet the applicable requirements of NFPA 70 and shall be of the motor-circuit protector type.

Circuit breakers used for service disconnection shall be the enclosed circuit-breaker type with external handle for manual operation. Enclosures shall be sheet metal with a hinged cover suitable for surface mounting.

2.4.2 Enclosed Molded-Case Circuit Breakers

Enclosed circuit breakers shall be thermal-magnetic molded-case circuit breakers in surface-mounted, nonventilated enclosures conforming to the appropriate articles of NEMA 250 and NEMA AB 1.

Enclosed circuit breakers in nonhazardous locations shall be as follows:

Circuit breakers installed inside, clean, dry locations shall be contained in NEMA Type 1, general purpose sheet steel enclosures.

Circuit breakers installed in unprotected outdoor locations shall be contained in NEMA Type 3R, weather-resistant sheet steel enclosures that are splashproof, weatherproof, sleetproof, and moisture resistant.

Circuit breakers installed in wet locations shall be contained in NEMA Type 4, watertight corrosion-resistant sheet steel enclosures constructed to prevent entrance of water.

Circuit breakers installed in industrial locations shall be contained in NEMA Type 12, industrial-use sheet steel enclosures constructed to prevent the entrance of dust, lint, fibers and flyings, and oil and coolant seepage.

Steel enclosures shall be fabricated from corrosion-resistant steel sheet conforming to ASTM A 167, 300 series corrosion-resistant steel. Box dimensions and thickness of sheet steel shall be in accordance with UL 50.

2.5 FUSES

A complete set of fuses for all switches and switchgear shall be provided. Fuses shall have a voltage rating not less than the circuit voltage.

Fuses rated 30 amperes, 125 volts or less shall be the nonrenewable cartridge type. Fuses rated above 30 amperes 600 volts or less shall be the renewable cartridge type with time-delay dual elements, except where otherwise indicated. Fuses shall conform to NEMA FU 1.

Special fuses such as extra-high interrupting-capacity fuses, fuses for welding machines, and capacitor fuses shall be installed where required. Plug fuses are not permitted.

Power fuses on ac systems above 600 volts shall be in accordance with NEMA

SG 2.

Fuses shall be labeled showing UL class, interrupting rating, and time-delay characteristics, when applicable. Additionally, fuse information shall be clearly listed on equipment drawings.

Fuse holders field-mounted in a cabinet or box shall be porcelain. Field installation of fuse holders made of such materials as ebony asbestos, Bakelite, or pressed fiber shall not be used.

2.6 CONTROL DEVICES

2.6.1 Magnetic Contactors

Magnetic contactors for the control of low-voltage, 60-hertz, tungsten-lamp loads, fluorescent-lamp loads, resistance-heating loads, and the primary windings of low-voltage transformers shall be in accordance with NEMA ICS 1 and NEMA ICS 2 as required.

Core-and-coil assembly shall operate satisfactorily with coil voltage between 85 and 110 percent of its voltage rating.

Contactors shall be designed with a normally open holding circuit auxiliary contact for control circuits. Rating of the auxiliary contact shall be in accordance with NEMA ICS 1 and NEMA ICS 2.

Solderless pressure wire terminal connectors shall be furnished or made available for line-and-load connections to contactors in accordance with NEMA ICS 1 and NEMA ICS 2.

Rating of magnetic contactors shall be in accordance with NEMA ICS 1 and NEMA ICS 2.

2.6.2 Control-Circuit Transformers

Control-circuit transformers shall be provided within the enclosure of magnetic contactors and motor controllers when the line voltage is in excess of 120 volts. Transformer shall be encapsulated dry type, single-phase, 60-hertz, with a 120-volt (or 24-volt) isolated secondary winding.

Rated primary voltage of the transformer shall be not less than the rated voltage of the controller. Rated secondary current of the transformer shall be not less than continuous-duty current of the control circuit.

Voltage regulation of the transformer shall be such that, with rated primary voltage and frequency, the secondary voltage shall not be less than 95 percent nor more than 105 percent of rated secondary voltage.

Source of supply for control-circuit transformers shall be the load side of the main disconnecting device. Secondary winding of the transformer and control-circuit wiring shall be protected against overloads and short circuits with fuses selected in accordance with JIC-01. Secondary winding of the control-circuit transformer shall be grounded in accordance with

JIC-01.

2.6.3 Magnetic Control Relays

Magnetic control relays for energizing and de-energizing the coils of magnetic contactors or other magnetically operated devices in response to variations in the conditions of electric control devices shall be in accordance with NEMA ICS 1, and NEMA ICS 2.

Core-and-coil assembly shall operate satisfactorily with coil voltages between 85 and 110 percent of their voltage rating.

Relays shall be designed to accommodate normally open and normally closed contacts.

Magnetic control relays shall be 120-volt, 60-hertz, Class AIB devices with a continuous contact rating of 10 amperes and with current-making and -breaking ability in accordance with NEMA ICS 1 and NEMA ICS 2, two normally open and two normally closed.

2.6.4 Pushbuttons and Switches

2.6.4.1 Pushbuttons

Pushbuttons for low-voltage ac full-voltage magnetic controllers shall be heavy-duty oiltight NEMA 250, Type 12, momentary-contact devices rated 600 volts, with pilot light, and with the number of buttons and the marking of identification plates as shown. Color code for pushbuttons shall be in accordance with JIC-01.

Pushbuttons shall be designed with normally open, circuit-closing contacts; normally closed circuit-opening contacts; and two-circuit normally open and normally closed circuit-closing and -opening contacts. Pushbutton-contact ratings shall be in accordance with NEMA ICS 1 and NEMA ICS 2 with contact designation A600.

Pushbuttons in remote control stations shall be identified with identification plates affixed to front cover in a prominent location. Identification plate shall carry the identification of the system being controlled.

2.6.4.2 Selector Switches

Selector switches for low-voltage control circuits shall be heavy-duty oiltight maintained-contact devices with the number of positions and the marking of identification plates in accordance with NEMA ICS 1 and NEMA ICS 2.

Selector switches in remote control stations shall be identified with engraved identification plates affixed to front cover in a prominent location. Identification plate shall carry the identification of the system being controlled.

2.6.4.3 Miscellaneous Switches

Float, limit, door, pressure, proximity, and other types of switches shall be in accordance with IPC D330 and of the types and classes indicated.

2.9 INDICATING INSTRUMENTS

2.7 watt-Hour Meters/wattmeters

Watt-hour meters, wattmeters, and pulse initiation meters shall conform to IEEE C12.1.

Pulse initiating meters for use with demand meters or pulse recorders shall be suitable for use with mechanical or electrical pulse initiators. Mechanical load imposed on the meter by the pulse initiator shall be within the limits of the pulse meter. Load shall be as constant as practical throughout the entire cycle of operation to ensure accurate meter readings.

Pulse initiating meter shall be capable of measuring the maximum number of pulses at which the pulse device is nominally rated. Pulse initiating meter may be considered to be operating properly when a kilowatthour check indicates that the demand meter kilowatthours are within limits of the watthour meter kilowatthours.

Pulse initiating meters shall be located such that components sensitive to moisture and temperature conditions are minimized. Precautions shall be taken to protect sensitive electronic metering circuitry from electromagnetic and electrostatic induction.

Meters shall be removable and shall be furnished with draw out test plug. Contact devices shall be furnished to operate remote impulse-totalizing graphic demand meters.

Case shall be semiflush-mounted to the hinged instrument panel and shall have a matching cover.

2.8 FACTORY TESTING

Factory tests on control and low voltage protective devices shall be performed in accordance with the manufacturer's recommendations.

Short-circuit tests shall be in accordance with Section 2 of NEMA ICS 1.

Factory tests on power, high-voltage, and oil circuit breakers shall be in accordance with ANSI C37.09.

2.9 INDICATING LIGHTS

2.9.1 General-Purpose Type

Indicating lights shall be oiltight instrument devices with threaded base and collar for flush-mounting, translucent convex lens, candelabra screw-base lampholder, and 120-volt, 6-watt, Type S-6 incandescent lamp in accordance with ANSI C78.23. Color code for indicating lights shall be in accordance with JIC-01.

Indicating lights shall be provided in remote-control stations when pushbuttons and selector switches are out of sight of the controller.

2.10 FINISH

Metallic materials shall be protected against corrosion. Equipment shall have the standard finish by the manufacturer when used for most indoor installations. For harsh indoor environments (any area subjected to chemical and/or abrasive action), and all outdoor installations, refer to Section 09960 HIGH PERFORMANCE COATINGS.

PART 3 EXECUTION

3.1 INSTALLATION

Control devices and protective devices not factory installed in equipment shall be installed in accordance with the manufacturer's recommendations and shall be field adjusted and operation tested. Installations shall conform to NFPA 70, NEMA ICS 1, NEMA ICS 2, and NEMA ICS 3 requirements for installation of control and protective devices.

3.2 FIELD TESTING

Control and protective devices not factory installed in equipment shall be demonstrated to operate as indicated.

Instrumentation, potential, and current transformers shall be ratio'd and tap settings verified.

Circuit breakers rated 15KV and above shall be given a timing test to verify proper contact speed, travel, bounce, and wipe.

Oil and high-voltage circuit breakers and their bushings shall be given an insulation power factor test to establish condition monitoring baselines.

Insulating oil in oil circuit breakers shall have dielectric tests performed before the breakers are energized. Oil shall be tested in accordance with ASTM D 877, and breakdown voltage shall be not less than 25,000 volts. Manufacturer shall certify that the oil contains no PCB's and shall affix a label to that effect on each breaker tank and on each oil drum containing the insulating oil.

Reduced-voltage starting devices shall be field adjusted to obtain optimum operating conditions. Test meters and instrument transformers shall conform to IEEE C12.1 and IEEE C57.13.

Control and protective devices shall not be energized until recorded test data have been approved by the Contracting Officer. Final test reports shall be provided to the Contracting Officer. Reports shall have a cover letter/sheet clearly marked with the System name, Date, and the words "Final Test Reports - Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database."

-- End of Section --

SECTION 16315

MEDIUM VOLTAGE OVERHEAD POWER DISTRIBUTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C135.6	(1988) Zinc-Coated Ferrous Crossarm Braces for Overhead Line Construction
ANSI C29.2	(1992; R 1999) Insulators - Wet-Process Porcelain and Toughened Glass - Suspension Type
ANSI C29.3	(1986; R 1995) Wet Process Porcelain Insulators - Spool Type
ANSI C29.4	(1989; R 1995) Wet-Process Porcelain Insulators - Strain Type
ANSI C29.6	(1996; R 1996) Wet-Process Porcelain Insulators - High-Voltage Pin Type
ANSI C29.7	(1996) Porcelain Insulators - High-Voltage Line Post Type

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA A3	(2000) Determining Penetration of Preservatives and Fire Retardants
AWPA C1	(2003) All Timber Products - Preservative Treatment by Pressure Processes
AWPA C25	(2001) Sawn Crossarms - Preservative Treatment by Pressure Processes
AWPA C4	(1995) Poles - Preservative Treatment by Pressure Processes

ASTM INTERNATIONAL (ASTM)

ASTM A 675/A 675M	(2003) Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
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ASTM D 1625 (1971; R 2000) Standard Specifications for
Chromated Copper Arsenate

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C135.1 (1999) Standard for Zinc-Coated Steel
Bolts and Nuts for Overhead Line
Construction

IEEE C2 (2002) National Electrical Safety Code

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Material, Equipment and Fixture Schedule

SD-02 Shop Drawings

Fabrication Drawings
Installation Drawings

SD-03 Product Data

Manufacturer's product data shall be submitted for the following items:

Crossarms and Timbers
Crossarm Braces
Hardware, Pins, and Racks
Insulators
Guys
Accessories

SD-07 Certificates

Certificates shall be submitted for the following items showing conformance with the referenced standards contained in this section.

Crossarms and Timbers
Crossarm Braces
Hardware, Pins, and Racks
Insulators
Guys
Accessories

1.3 GENERAL REQUIREMENTS

Section 16003 GENERAL ELECTRICAL PROVISIONS applies to work specified in

this section.

1.4 MATERIAL, EQUIPMENT AND FIXTURE SCHEDULE

Material, equipment and fixture schedule shall be submitted for overhead pole line assemblies including manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site information.

PART 2 PRODUCTS

2.1 FABRICATION DRAWINGS

Fabrication Drawings shall be submitted for the following items consisting of fabrication and assembly details to be performed in the factory.

- Crossarms and Timbers
- Crossarm Braces
- Hardware, Pins, and Racks
- Insulators
- Guys
- Accessories

2.2 WOOD

2.2.1 Preservative

Preservative used for humid, harsh environment shall be Chromated Copper Arsenate type (A)(B)(C) conforming to AWPAC4 and ASTM D 1625.

2.2.2 Preservative Application

Preservative treatment shall be applied using a pressure process conforming to AWPAC1 and AWPAC4 for Southern Pine. Penetration of preservatives shall be determined as specified in AWPAC3 and complete sapwood penetration shall be obtained.

2.3 CROSSARMS AND TIMBERS

Before pressure treatment, crossarms shall be machined, chamfered, trimmed, and bored for pins and bolts required.

Crossarms and timbers shall be straight and close-grained pressure treated Southern pine, pressure-treated to 8 pounds minimum retention with complete sapwood penetration. Treatment of crossarms and timbers shall meet the requirements of AWPAC25.

Crossarms shall be 4-1/4 by 5-1/4 inches by 9 feet, unless other dimensions are indicated, and straight and free of twists to within 1/10 inch per foot of length. Bends or twists shall be in one direction only.

Vertical and longitudinal strength of crossarms shall conform to IEEE C2.

2.4 CROSSARM BRACES

Crossarm braces shall be zinc-coated structural steel conforming to ASTM A 675/A 675M.

Crossarm braces shall meet the requirements of ANSI C135.6.

Angle braces shall be 60-inches span by 18 inches, drop-formed in one piece from a 1-3/4 by 1-3/4-inch angle.

Flat braces shall be 1/4 inch by 1-1/4 inches, not less than 20-inches long for arms 4 feet or less in length, and not less than 28-inches long for arms exceeding 4 feet in length.

2.5 HARDWARE, PINS, AND RACKS

2.5.1 Miscellaneous Hardware

Pole-line hardware shall be hot-dip galvanized after fabrication.

Suitable washers shall be installed under bolt heads and nuts on wood surfaces. Washers used on thru-bolts and double-arming bolts shall be approximately 2-1/4-inches square and 3/16-inch thick. Diameter of holes in washers shall be the correct standard size for the bolts with which the washers are used. Washers for use under the heads of carriage bolts shall be the proper size to fit over the square shank of the bolt.

Pole line hardware shall meet the requirements of IEEE C135.1 for steel bolts and nuts.

2.5.2 Pins

Pins shall be zinc-coated forged steel with lead-thread height to suit the insulator to be installed, but not less than 4-1/2-inches high by 5/8-inch diameter. Shoulder shall be not less than 2-inch diameter and shall be designed to distribute the load uniformly to the crossarm. Shank shall be not less than 5/8-inch diameter by 5-3/4-inch length, equipped with a 2-inch square washer, nut, and locknut, and shall project not less than 1/8 inch nor more than 2 inches beyond the locknut. Broad-base corner pins of drop-forged welded steel or malleable iron shall be used for turning small angles, as indicated.

2.5.3 Hot-Line Clamps

Connections to overhead primary conductors shall be made with hot-line clamps of the screw type with concealed threads. Thread chamber shall be filled with corrosion-resistant compound. Hot-line clamp tap conductor shall be bare soft-drawn seven-strand No. 4 copper, except that the hot-line clamp tap conductor for lateral lines No. 2 and larger shall be bare soft-drawn copper of the same size and stranding as the lateral line.

Stirrups shall be provided for hot-line clamp connections, shall be 4 by 4 inches, and shall be constructed of bare hard-drawn copper the same size as the tap line but not less than No. 4.

2.5.4 Secondary Racks

Secondary racks shall be the 2-, 3-, or 4-wire type as required and shall be furnished complete with spool insulators.

Racks shall meet industry requirements for the strength and deflection of heavy-duty steel racks and shall be either galvanized steel or aluminum alloy.

Top of insulator points shall be rounded and smooth. Insulators shall be held in place with a 5/8-inch buttonhead bolt equipped with a nonferrous cotter pin, or equivalent, at the bottom.

2.6 INSULATORS

Insulators for use on primary open-wire construction shall conform to ANSI C29.2, ANSI C29.3, ANSI C29.4, ANSI C29.6, and ANSI C29.7.

Insulators shall have a minimum wet flashover rating of 80 kV.

Suspension insulators shall be used on the primary system at corners, angles greater than 5 degrees, suspended buses, dead ends, and wherever pin insulators do not provide adequate strength.

Mechanical strength of suspension and strain insulators shall exceed the ultimate tensile strength of the conductor or guy attached thereto.

Pin insulators used on voltages in excess of 5,000 volts phase-to-phase shall be radio-noise free.

Insulators for various uses shall have ratings not lower than the classes indicated as follows:

<u>SERVICE</u>	<u>PIN</u>	<u>LINE POST</u>	<u>SUSPENSION</u>
5,001- to 15,000-volt	56-3	27-21 or 2s	3 X 52-2*

*With a 12-inch extension link in the center phase.

Spool insulators used on secondaries shall be not smaller than Class 52-2. For conductors No. 4/0 and larger, Class 52-4 spool insulators shall be used.

Insulator testing shall be in accordance with ANSI C29.2.

2.7 FACTORY TESTING AND INSPECTION

Inspection of poles, crossarms, and timbers shall be accomplished by a recognized independent timber inspection company. Qualifications of the company shall be subject to approval. Poles, crossarms, and timbers shall be inspected prior and subsequent to treatment. For the material to be acceptable, the inspection company shall certify that the wood, treating material, and treatment are all in accordance with this specification.

PART 3 EXECUTION

3.1 CROSSARMS AND TIMBERS

Crossarms shall be set at right angles to line for straight runs and shall bisect the angle of turns.

Double crossarms shall be securely held in position by means of 5/8 inch double-arming bolts. Each double-arming bolt shall be equipped with four nuts and four square washers.

Crossarms shall be bolted to poles with 5/8 inch thru-bolts with square washers at each end. Bolts shall extend not less than 1/8-inch nor more than 2-inches beyond the nut.

3.2 CROSSARM BRACES

Crossarm braces shall be provided on crossarms.

Flat braces shall be bolted to arms with 3/8 inch carriage bolts with a round washer between bolthead and crossarm and shall be secured to poles with 1/2 inch by 4 inch lag screws after crossarms are leveled and aligned.

Angle braces shall be bolted to crossarms with 1/2 inch bolts with a round washer between bolthead and crossarm and shall be secured to poles with 5/8 inch thru-bolts.

3.3 HARDWARE, PINS, AND RACKS

Eyebolts, bolt eyes, eyenuts, strain load plates, lag screws, guy clamps, fasteners, hooks, shims, and clevises shall be used wherever required to adequately support and protect the poles, crossarms, guy wires, and insulators. Hardware shall be the correct size to fit the pole and crossarms on which they are being installed.

Racks for dead-ending four No. 4/0 or larger conductors shall be attached to poles with three 5/8 inch thru-bolts. Other secondary racks shall be attached to poles with at least two 5/8 inch thru-bolts.

Minimum vertical spacing between conductors shall be as follows:

<u>SPAN LENGTH (FEET)</u>	<u>VERTICAL SPACING BETWEEN CONDUCTORS (INCHES)</u>
Up to 200	6
201 to 250	8
251 to 300	12

3.4 FIELD TESTING

At least one anchor of each capacity installed shall be field-tested to

ensure that the anchor develops rated holding power as indicated, without noticeable creepage. In the event of failure of a test anchor, all anchors of the size that failed shall be tested and those that fail shall be replaced; replacements shall be tested in the same manner as the original anchor. Materials, labor, and equipment required to perform the above test and for replacing anchors that fail shall be furnished at no additional cost to the Government. Anchors shall be tested prior to hanging guys. Anchors to be used as test anchors will be picked at random by the Government after all anchors have been installed.

-- End of Section --

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SECTION 16375

ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.10	(1997) Watthour Meters
ANSI C12.11	(1987) Instrument Transformers for Revenue Metering, 10 kV BIL through 350 kV BIL (0.6 kV NSV through 69 kV NSV)
ANSI C12.4	(1984; R 1990) Mechanical Demand Registers
ANSI C29.1	(1988; R 2002) Test Methods for Electrical Power Insulators
ANSI C37.46	(2000) For High Voltage Expulsion and Current-Limiting Type Power Class Fuses and Fuse Disconnecting Switches
ANSI C57.12.21	(1992) Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Single-Phase Distribution Transformers with High-Voltage Bushings; High Voltage, 34 500 Grd Y/199200 Volts and Below; Low Voltage, 2400/120 Volts; 167 kVA and Smaller
ANSI C57.12.26	(1993) Pad-Mounted Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 34 500 Grd Y/19 920 Volts and Below; 2500 kVA and Smaller
ANSI C62.2	(1987; R 1994) Guide for the Application of Gapped Silicon-Carbide Surge Arresters for Alternating Current Systems
ANSI C80.1	(1994) Rigid Steel Conduit - Zinc Coated

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS5 (1994; CS5a-1995) Cross-Linked
Polyethylene Insulated Shielded Power
Cables Rated 5 Through 46 kV

AEIC CS6 (1996) Ethylene Propylene Rubber Insulated
Shielded Power Cables Rated 69 kV

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M (2002) Zinc (Hot-Dip Galvanized) Coatings
on Iron and Steel Products

ASTM A 153/A 153M (2003) Zinc Coating (Hot-Dip) on Iron and
Steel Hardware

ASTM B 117 (2002) Operating Salt Spray (Fog) Apparatus

ASTM B 496 (2001) Compact Round
Concentric-Lay-Stranded Copper Conductors

ASTM B 8 (1999) Concentric-Lay-Stranded Copper
Conductors, Hard, Medium-Hard, or Soft

ASTM D 1654 (1992; R 2000) Evaluation of Painted or
Coated Specimens Subjected to Corrosive
Environments

ASTM D 4059 (2000) Analysis of Polychlorinated
Biphenyls in Insulating Liquids by Gas
Chromatography

ASTM D 923 (1997) Sampling Electrical Insulating
Liquids

FM GLOBAL (FM)

FM P7825a (2003) Approval Guide Fire Protection

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2002) National Electrical Safety Code

IEEE C57.12.00 (2000) General Requirements for
Liquid-Immersed Distribution, Power, and
Regulating Transformers

IEEE C57.13 (1993) Requirements for Instrument
Transformers

IEEE C57.98 (1994) Guide for Transformer Impulse Tests

IEEE C62.1 (1989; R 1994) Gapped Silicon-Carbide
Surge Arresters for AC Power Circuits

IEEE C62.11	(1999) Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1KV)
IEEE Std 100	(2000) IEEE Standard Dictionary of Electrical and Electronics Terms
IEEE Std 404	(2000) Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500 V Through 500 000 V
IEEE Std 48	(1996; R 2003) Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV
IEEE Std 592	(1990) Exposed Semiconducting Shields on High Voltage Cable Joints and Separable Insulated Connectors
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)Normal Measurements

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA FB 1	(2001) Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
NEMA LA 1	(1992; R 1999) Surge Arresters
NEMA TC 6	(1990) PVC and ABS Plastic Utilities Duct for Underground Installation
NEMA WC 7	(1988; Rev 3 1996) Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NEMA WC 8	(1988; Rev 3 1996) Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code
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UNDERWRITERS LABORATORIES (UL)

UL 1072	(2001; Rev thru Apr 2003) Medium-Voltage Power Cables
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UL 1242	(2000; Rev thru May 2003) Electrical Intermediate Metal Conduit -- Steel
UL 467	(1993; Rev thru Feb 2001) Grounding and Bonding Equipment
UL 510	(1994; Rev thru Apr 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 514A	(2004) Metallic Outlet Boxes
UL 6	(2000; Rev thru May 2003) Rigid Metal Conduit
UL 651	(1995; Rev thru Oct 2002) Schedule 40 and 80 Rigid PVC Conduit

1.2 GENERAL REQUIREMENTS

1.2.1 Terminology

Terminology used in this specification is as defined in IEEE Std 100.

1.2.2 Service Conditions

Items provided under this section shall be specifically suitable for the following service conditions.

- b. Altitude 4000 feet
- c. Ambient Temperature 140 degrees F
- d. Frequency 60 Hz

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Electrical Distribution System

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams manufacturers standard installation drawings and other information necessary to define the installation and enable the Government to check conformity with the requirements of the contract drawings.

If departures from the contract drawings are deemed necessary by

the Contractor, complete details of such departures shall be included with the detail drawings. Approved departures shall be made at no additional cost to the Government.

Detail drawings shall show how components are assembled, function together and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission. Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall consist of the following:

- a. Detail drawings showing physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. All optional items shall be clearly identified as included or excluded.
- b. Internal wiring diagrams of equipment showing wiring as actually provided for this project. External wiring connections shall be clearly identified.

Detail drawings shall as a minimum depict the installation of the following items:

- a. Medium-voltage cables and accessories including cable installation plan.
- b. Transformers.
- c. Pad-mounted loadbreak switches.
- d. Surge arresters.

As-Built Drawings

The as-built drawings shall be a record of the construction as installed. The drawings shall include the information shown on the contract drawings as well as deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be a full sized set of prints marked to reflect deviations, modifications, and changes. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall provide three full sized sets of the

marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction.

The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within 10 calendar days from the time the drawings are returned to the Contractor.

SD-03 Product Data

Fault Current Analysis; G
Protective Device; G
Coordination Study; G

The study shall be submitted with protective device equipment submittals. No time extension or similar contract modifications will be granted for work arising out of the requirements for this study. Approval of protective devices proposed shall be based on recommendations of this study. The Government shall not be held responsible for any changes to equipment, device ratings, settings, or additional labor for installation of equipment or devices ordered and/or procured prior to approval of the study.

Nameplates; G

Catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material and Equipment; G

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each such item.

General Installation Requirements; G

As a minimum, installation procedures for transformers, substations, switchgear, and splices.

Procedures shall include cable pulling plans, diagrams, instructions, and precautions required to install, adjust, calibrate, and test the devices and equipment.

SD-06 Test Reports

Factory Tests

Certified factory test reports shall be submitted when the manufacturer performs routine factory tests, including tests required by standards listed in paragraph REFERENCES. Results of factory tests performed shall be certified by the manufacturer, or an approved testing laboratory, and submitted within 7 days following successful completion of the tests. The manufacturer's

pass-fail criteria for tests specified in paragraph FIELD TESTING shall be included.

Field Testing

A proposed field test plan, 30 days prior to testing the installed system. No field test shall be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Operating Tests

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. A list of equipment used, with calibration certifications.
- b. A copy of measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.
- e. The condition specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.

Cable Installation

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings from which material may readily be removed and replaced, including a separate section for each cable pull. Sections shall be separated by heavy plastic dividers with tabs, with all data sheets signed and dated by the person supervising the pull.

- a. Site layout drawing with cable pulls numerically identified.
- b. A list of equipment used, with calibration certifications. The manufacturer and quantity of lubricant used on pull.
- c. The cable manufacturer and type of cable.
- d. The dates of cable pulls, time of day, and ambient temperature.
- e. The length of cable pull and calculated cable pulling tensions.

f. The actual cable pulling tensions encountered during pull.

SD-07 Certificates

Material and Equipment

Where materials or equipment are specified to conform to the standards of the Underwriters Laboratories (UL) or to be constructed or tested, or both, in accordance with the standards of the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers (IEEE), or the National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided conform to such requirements.

The label of, or listing by, UL will be acceptable as evidence that the items conform. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable as evidence that the item conforms. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard, by a company listed as a member company of NEMA, will be acceptable as evidence that the item conforms. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the specified agencies. Compliance with above-named requirements does not relieve the Contractor from compliance with any other requirements of the specifications.

Cable Joints

A certification that contains the names and the qualifications of people recommended to perform the splicing and termination of medium-voltage cables approved for installation under this contract. The certification shall indicate that any person recommended to perform actual splicing and terminations has been adequately trained in the proper techniques and have had at least three recent years of experience in splicing and terminating the same or similar types of cables approved for installation. In addition, any person recommended by the Contractor may be required to perform a practice splice and termination, in the presence of the Contracting Officer, before being approved as a qualified installer of medium-voltage cables. If that additional requirement is imposed, the Contractor shall provide short sections of the approved types of cables along with the approved type of splice and termination kits, and detailed manufacturer's instruction for the proper splicing and termination of the approved cable types.

Cable Installer Qualifications

The Contractor shall provide at least one onsite person in a

supervisory position with a documentable level of competency and experience to supervise all cable pulling operations. A resume shall be provided showing the cable installers' experience in the last three years, including a list of references complete with points of contact, addresses and telephone numbers.

SD-10 Operation and Maintenance Data

Electrical Distribution System

Six copies of operation and maintenance manuals, within 7 calendar days following the completion of tests and including assembly, installation, operation and maintenance instructions, spare parts data which provides supplier name, current cost, catalog order number, and a recommended list of spare parts to be stocked. Manuals shall also include data outlining detailed procedures for system startup and operation, and a troubleshooting guide which lists possible operational problems and corrective action to be taken. A brief description of all equipment, basic operating features, and routine maintenance requirements shall also be included. Documents shall be bound in a binder marked or identified on the spine and front cover. A table of contents page shall be included and marked with pertinent contract information and contents of the manual. Tabs shall be provided to separate different types of documents, such as catalog ordering information, drawings, instructions, and spare parts data. Index sheets shall be provided for each section of the manual when warranted by the quantity of documents included under separate tabs or dividers.

Three additional copies of the instructions manual shall be provided within 30 calendar days following the manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Oil filled transformers and switches shall be stored in accordance with the manufacturer's requirements.

1.5 EXTRA MATERIALS

One additional spare fuse or fuse element for each furnished fuse or fuse element shall be delivered to the contracting officer when the electrical system is accepted. Two complete sets of all special tools required for maintenance shall be provided, complete with a suitable tool box. Special tools are those that only the manufacturer provides, for special purposes (to access compartments, or operate, adjust, or maintain special parts).

PART 2 PRODUCTS

2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 NAMEPLATES

2.2.1 General

Each major component of this specification shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a nameplate securely attached to the equipment. Nameplates shall be made of noncorrosive metal. Equipment containing liquid dielectrics shall have the type of dielectric on the nameplate. Sectionalizer switch nameplates shall have a schematic with all switch positions shown and labeled. As a minimum, nameplates shall be provided for transformers, circuit breakers, meters, switches, and switchgear.

2.2.2 Liquid-Filled Transformer Nameplates

Power transformers shall be provided with nameplate information in accordance with IEEE C57.12.00. Nameplates shall indicate the number of gallons and composition of liquid-dielectric, and shall be permanently marked with a statement that the transformer dielectric to be supplied is non-polychlorinated biphenyl. If transformer nameplate is not so marked, the Contractor shall furnish manufacturer's certification for each transformer that the dielectric is non-PCB classified, with less than 2 ppm PCB content in accordance with paragraph LIQUID DIELECTRICS. Certifications shall be related to serial numbers on transformer nameplates. Transformer dielectric exceeding the 2 ppm PCB content or transformers without certification will be considered as PCB insulated and will not be accepted.

2.3 CORROSION PROTECTION

2.3.1 Aluminum Materials

Aluminum shall not be used.

2.3.2 Ferrous Metal Materials

2.3.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M and ASTM A 123/A 123M.

2.3.2.2 Equipment

Equipment and component items, including but not limited to transformer stations and ferrous metal luminaries not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 120 hours of exposure to the salt spray test specified in

ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1/16 inch from the test mark. The scribed test mark and test evaluation shall be in accordance with ASTM D 1654 with a rating of not less than 7 in accordance with TABLE 1, (procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

2.3.3 Finishing

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory shall be as specified in Section 09900 PAINTS AND COATINGS.

2.4 CABLES

Cables shall be single conductor type unless otherwise indicated.

2.4.1 Medium-Voltage Cables

2.4.1.1 General

Cable construction shall be Type MV, conforming to NFPA 70 and UL 1072 underground distribution cable conforming to AEIC CS5 and NEMA WC 7. Cables shall be manufactured for use in applications as indicated.

2.4.1.2 Ratings

Cables shall be rated for a circuit voltage of 15 kV.

2.4.1.3 Conductor Material

Underground cables shall be soft drawn copper complying with ASTM B 496 for compact stranding.

2.4.1.4 Insulation

Cable insulation shall be ethylene-propylene-rubber (EPR) insulation conforming to the requirements of NEMA WC 8 and AEIC CS6. A 133 percent insulation level shall be used on 15 kV rated cables. The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

2.4.1.5 Shielding

Cables rated for 2 kV and above shall have a semiconducting conductor shield, a semiconducting insulation shield, and an overall copper wire with 6 corrugated drain wires, general cable unshield or approved equal.

2.4.1.6 Jackets

Cables shall be provided with a flame retardant chlorinated polyethylene (CPE) jacket.

2.5 CABLE JOINTS, TERMINATIONS, AND CONNECTORS

2.5.1 Medium-Voltage Cable Joints

Medium-voltage cable joints shall comply with IEEE Std 404 and IEEE Std 592.

Medium-voltage cable terminations shall comply with IEEE Std 48. Joints shall be the standard products of a manufacturer and shall be either of the factory preformed type or of the kit type containing tapes and other required parts. Joints shall have ratings not less than the ratings of the cables on which they are installed. Splice kits may be of the heat-shrinkable type for voltages up to 15 kV, of the premolded splice and connector type, the conventional taped type, or the resin pressure-filled overcast taped type for voltages up to 35 kV; except that for voltages of 7.5 kV or less a resin pressure-filled type utilizing a plastic-tape mold is acceptable. Joints used in manholes, handholes, vaults and pull boxes shall be certified by the manufacturer for waterproof, submersible applications.

2.5.2 Terminations

Terminations shall be in accordance with IEEE Std 48, Class 1 or Class 2; of the molded elastomer, wet-process porcelain, prestretched elastomer, heat-shrinkable elastomer, or taped type. Acceptable elastomers are track-resistant silicone rubber or track-resistant ethylene propylene compounds, such as ethylene propylene rubber or ethylene propylene diene monomer. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Terminations shall be of the outdoor type, except that where installed inside outdoor equipment housings which are sealed against normal infiltration of moisture and outside air, indoor, Class 2 terminations are acceptable. Class 3 terminations are not acceptable. Terminations, where required, shall be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding, metallic sheath, and armor.

2.5.2.1 Factory Preformed Type

Molded elastomer, wet-process porcelain, prestretched, and heat-shrinkable terminations shall utilize factory preformed components to the maximum extent practicable rather than tape build-up. Terminations shall have basic impulse levels as required for the system voltage level. Leakage distances shall comply with wet withstand voltage test requirements of IEEE Std 48 for the next higher Basic Insulation Level (BIL) level. Anti-tracking tape shall be applied over exposed insulation of preformed molded elastomer terminations.

2.6 CONDUIT AND DUCTS

Ducts shall be single, round-bore type, with wall thickness and fittings suitable for the application. Duct lines shall be concrete-encased, thin-wall type for duct lines between manholes and for other medium-voltage lines. Low-voltage lines or Communication lines run elsewhere may be direct-burial, thick-wall type.

2.6.1 Metallic Conduit

Intermediate metal conduit shall comply with UL 1242. Rigid galvanized steel conduit shall comply with UL 6 and ANSI C80.1. Metallic conduit fittings and outlets shall comply with UL 514A and NEMA FB 1.

2.6.2 Nonmetallic Ducts

2.6.2.1 Concrete Encased Ducts

UL 651 Schedule 40 or NEMA TC 6 & 8 Type DB-60.

2.6.2.2 Direct Burial

UL 651 Schedule 40 and Schedule 80, or NEMA TC 6 Type DB-60.

2.6.3 Conduit Sealing Compound

Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 35 degrees F, shall neither slump at a temperature of 300 degrees F, nor harden materially when exposed to the air. Compounds shall adhere to clean surfaces of fiber or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials.

2.7 TRANSFORMERS

Transformers shall be of the outdoor type having the ratings and arrangements indicated. Medium-voltage ratings of cable terminations shall be 15 kV between phases for 133 percent insulation level.

2.7.1 Pad-Mounted Transformers

Pad-mounted transformers shall comply with ANSI C57.12.26 and shall be of the loop feed type. Pad-mounted transformer stations shall be assembled and coordinated by one manufacturer and each transformer station shall be shipped as a complete unit so that field installation requirements are limited to mounting each unit on a concrete pad and connecting it to primary and secondary lines. Stainless steel pins and hinges shall be provided. Barriers shall be provided between high- and low-voltage compartments. High-voltage compartment doors shall be interlocked with low-voltage compartment doors to prevent access to any high-voltage section unless its associated low-voltage section door has first been opened. Compartments shall be sized to meet the specific dimensional requirements of ANSI C57.12.26. Pentahead locking bolts shall be provided with provisions for a padlock.

2.7.1.1 High-Voltage Compartments

The high-voltage compartment shall be dead-front construction. Primary switching and protective devices shall include loadbreak switching,

drawout, dry-well-mounted, current-limiting fuses, medium-voltage separable loadbreak connectors, universal bushing wells and inserts or integral one piece bushings and surge arresters. Fuses shall comply with the requirements of paragraph METERING AND PROTECTIVE DEVICES. The switch shall be mounted inside transformer tank with switch operating handle located in high-voltage compartment and equipped with metal loop for hook stick operation. Fuses shall be interlocked with switches so that fuses can be removed only when the associated switch is in the "OPEN" position. Adjacent to medium-voltage cable connections, a nameplate or equivalent stencilled inscription shall be provided inscribed "DO NOT OPEN CABLE CONNECTORS UNLESS SWITCH IS OPEN." Surge arresters shall be fully insulated and configured to terminate on the same bushing as the primary cable by means of a loadbreak, feed-through bushing insert.

2.7.1.2 Load-Break Switch

Loop feed sectionalizer switches: Provide three, two-position, oil-immersed type switches to permit closed transition loop feed and sectionalizing. Each switch shall be rated at 15 kV, 95 kV BIL, with a continuous current rating and load-break rating of 200 amperes, and a make-and-latch rating of 10,000 rms amperes symmetrical. Locate the switch handle in the high-voltage compartment. Operation of switches shall be as follows:

ARRANGEMENT #	DESCRIPTION OF SWITCH ARRANGEMENT	SWITCH POSITION			
		LINE A SW OPEN CLOSE	LINE B SW OPEN CLOSE	XFMR SW OPEN CLOSE	
1	Line A connected to Line B and both lines connected to transformer	X	X		X
2	Transformer connected to Line A only	X	X		X
3	Transformer connected to Line B only	X	X		X
4	Transformer open and loop closed	X	X	X	
5	Transformer open and loop open	X	X	X	

2.7.1.3 Transformer Tank Sections

Transformers shall comply with IEEE C57.12.00, ANSI C57.12.21, and ANSI C57.12.26 and shall be of the mineral oil-insulated type. Transformers

shall be suitable for outdoor use and shall have 2 separate windings per phase. Standard NEMA primary taps shall be provided. Where primary taps are not specified, 4, 2-1/2 percent rated kVA high-voltage taps shall be provided 2 above and 2 below rated, primary voltage. Operating handles for primary tap changers for de-energized operation shall be located within high-voltage compartments, externally to transformer tanks. Adjacent to the tap changer operating handle, a nameplate or equivalent stenciled inscription shall be provided and inscribed "DO NOT OPERATE UNDER LOAD." Transformer ratings at 60 Hz shall be as follows:

Three-phase capacity.....500 kVA.
Impedance.....5.7.
Temperature Rise.....65 degrees C.
High-voltage winding.....12,470 volts.
High-voltage winding connections.....Delta.
Low-voltage winding.....208 volts.
Low-voltage winding connections..... WYE

2.7.1.4 Low-Voltage Cable Compartments

Neutrals shall be provided with fully-insulated bushings. Clamp type cable terminations, suitable for copper conductors entering from below, shall be provided as necessary.

2.7.1.5 Accessories

High-voltage warning signs shall be permanently attached to each side of transformer stations. Voltage warning signs shall comply with IEEE C2. Copper-faced steel or stainless steel ground connection pads shall be provided in both the high- and low-voltage compartments. Dial-type thermometer, liquid-level gauge, and drain valve with built-in sampling device shall be provided for each transformer station. Insulated-bushing-type parking stands shall be provided adjacent to each separable load-break elbow to provide for cable isolation during sectionalizing operations. Transformer KVA shall be stencilled on front exterior of unit in 3-inch high lettering in contrasting color per base standard. Finish shall be Fed Spec #23578, Antique Linen baked-on enamel.

2.8 METERING AND PROTECTIVE DEVICES

2.8.1 Fuses, Medium-Voltage, Including Current-Limiting

2.8.1.1 Construction

Units shall be suitable for outdoor use. Fuses shall have integral blown-fuse indicators. All ratings shall be clearly visible.

2.8.1.2 Ratings

Expulsion-type power fuses shall have ratings in accordance with ANSI C37.46 and as follows:

Nominal voltage.....12,470.
Maximum symmetrical interrupting capacity.....200 KA.
Rated continuous current.....150 percent.
BIL.....95 KV.

2.8.1.3 E-Rated, Current-Limiting Power Fuses

E-rated, current-limiting, power fuses shall conform to ANSI C37.46.

2.8.1.4 C-Rated, Current-Limiting Power Fuses

C-rated, current-limiting power fuses shall open in 1000 seconds at currents between 170 and 240 percent of the C rating.

2.8.2 Instrument Transformers

2.8.2.1 General

Instrument transformers shall comply with ANSI C12.11 and IEEE C57.13. Instrument transformers shall be configured for mounting in/on the device to which they are applied. Polarity marks on instrument transformers shall be visually evident and shown on drawings.

2.8.2.2 Current Transformers

Unless otherwise indicated, bar, wound, or window-type transformers are acceptable; and except for window-type units installed over insulated buses, transformers shall have a BIL rating consistent with the rated BIL of the associated switchgear or electric power apparatus bushings, buses or conductors. Current transformers shall have the indicated ratios. The continuous thermal-current rating factor shall not be less than 1.0. Other thermal and mechanical ratings of current transformers and their primary leads shall be coordinated with the design of the circuit breaker and shall be not less than the momentary rating of the associated circuit breaker. Circuit protectors shall be provided across secondary leads of the current transformers to prevent the accident open-circuiting of the transformers while energized. Each terminal of each current transformer shall be connected to a short-circuiting terminal block in the circuit interrupting mechanism cabinet, power transformer terminal cabinet, and in the associated instrument and relay cabinets.

2.8.2.3 Current Transformers for Kwh and Demand Metering (Low-Voltage)

Current transformers shall conform to IEEE C57.13. Provide current transformers with a metering accuracy Class of 0.3 through B-0.5, with a minimum RF of 1.5 at 30 degrees C, with 600-volt insulations, and 10 kV BIL. Provide butyl-molded, window-type current transformers mounted in the

current transformer cabinet.

2.8.3 Watthour Meters

Watthour meters shall conform to ANSI C12.10, except numbered terminal wiring sequence and case size may be the manufacturer's standard. Watthour meters shall be of the socket mounted outdoor type having a 15 minute, cumulative form, demand register meeting ANSI C12.4 and provided with not less than 2-1/2 staters. Watthour demand meters shall have factory-installed electronic pulse initiators. Pulse initiators shall be solid-state devices incorporating light-emitting diodes, phototransistors, and power transistors, except that mercury-wetted output contacts are acceptable. Initiators shall be totally contained within watthour demand meter enclosures, shall be capable of operating up to speeds of 500 pulses per minute with no false pulses, and shall require no field adjustments. Initiators shall be calibrated for a pulse rate output of 1 pulse per 1/4 disc revolution of the associated meter and shall be compatible with the indicated equipment.

2.9 SURGE ARRESTERS

Surge arresters shall comply with NEMA LA 1, IEEE C62.1, ANSI C62.2, and IEEE C62.11 and shall be provided where indicated. Arresters shall be station class, rated as shown. Arresters for use at elevations in excess of 6000 feet above mean sea level shall be specifically rated for that purpose. Arresters shall be equipped with mounting brackets suitable for the indicated installations. Arresters shall be of the metal-oxide varistor type.

2.10 GROUNDING AND BONDING

2.10.1 Driven Ground Rods

Ground rods shall be copper-clad steel conforming to UL 467 not less than 5/8 inch in diameter by 10 feet in length. Sectional type rods may be used.

2.10.2 Grounding Conductors

Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same material as phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be ASTM B 8 soft-drawn unless otherwise indicated. Aluminum is not acceptable.

2.11 CONCRETE AND REINFORCEMENT

Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03300A CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete reinforcing shall be as specified in Section 03200A CONCRETE REINFORCEMENT.

2.12 PADLOCKS

Padlocks shall comply with Section 08710 DOOR HARDWARE.

2.13 CABLE FIREPROOFING SYSTEMS

Cable fireproofing systems shall be listed in FM P7825a as a fire-protective coating or tape approved for grouped electrical conductors and shall be suitable for application on the type of medium-voltage cables provided. After being fully cured, materials shall be suitable for use where exposed to oil, water, gases, salt water, sewage, and fungus and shall not damage cable jackets or insulation. Asbestos materials are not acceptable.

2.13.1 Fireproof Coating

Cable fireproofing coatings shall be compounded of water-based thermoplastic resins, flame-retardant chemicals, and inorganic noncombustible fibers and shall be suitable for the application methods used. Coatings applied on bundled cables shall have a derating factor of less than 5 percent, and a dielectric strength of 95 volts per mil minimum after curing.

2.13.2 Fireproofing Tape

Fireproofing tape shall be at least 2 inches wide and shall be a flexible, conformable, polymeric, elastomer tape designed specifically for fireproofing cables.

2.13.3 Plastic Tape

Preapplication plastic tape shall be pressure sensitive, 10 mil thick, conforming to UL 510.

2.14 LIQUID DIELECTRICS

Liquid dielectrics for transformers, capacitors, reclosers, and other liquid-filled electrical equipment shall be non-polychlorinated biphenyl (PCB) mineral-oil or less-flammable liquid as specified. Nonflammable fluids shall not be used. Tetrachloroethylene (perchloroethylene) and 1, 2, 4 trichlorobenzene fluids shall not be used. Liquid dielectrics in retrofitted equipment shall be certified by the manufacturer as having less than 2 parts per million (ppm) PCB content. In lieu of the manufacturer's certification, the Contractor may submit a test sample of the dielectric in accordance with ASTM D 923 and have tests performed per ASTM D 4059 at a testing facility approved by the Contracting Officer. Equipment with test results indicating PCB level exceeding 50 ppm shall be replaced.

2.15 FACTORY TESTS

Factory tests shall be performed, as follows, in accordance with the applicable publications and with other requirements of these specifications. The Contracting Officer shall be notified at least 10 days before the equipment is ready for testing. The Contracting Officer reserves the right to witness the tests.

- a. Transformers: Manufacturer's standard routine tests in accordance with IEEE C57.12.00.
- b. Transformers rated 200 kVA and above: Reduced full-wave, chopped-wave, and full-wave impulse test on each line and neutral terminal, in accordance with IEEE C57.98.
- c. Factory Preformed Terminations: Wet withstand voltage tests in accordance with IEEE Std 48 for the next higher BIL level.
- d. Electrical Power Insulators: Manufacturer's standard tests in accordance with ANSI C29.1.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions. Steel conduits installed underground shall be installed and protected from corrosion in conformance with the requirements of Section 16402 INTERIOR DISTRIBUTION SYSTEM. Except as covered herein, excavation, trenching, and backfilling shall conform to the requirements of Section 02300 EARTHWORK. Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03300A CAST-IN-PLACE STRUCTURAL CONCRETE.

3.1.1 Conformance to Codes

The installation shall comply with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable.

3.1.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

3.1.3 Disposal of Liquid Dielectrics

PCB-contaminated dielectrics must be marked as PCB and transported to and incinerated by an approved EPA waste disposal facility. The Contractor shall furnish certification of proper disposal. Contaminated dielectrics shall not be diluted to lower the contamination level.

3.2 CABLE AND BUSWAY INSTALLATION

The Contractor shall obtain from the manufacturer an installation manual or set of instructions which addresses such aspects as cable construction, insulation type, cable diameter, bending radius, cable temperature, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, etc. The Contractor shall then [prepare a checklist of significant requirements] [perform pulling calculations and prepare a pulling plan] which shall be submitted along with the manufacturers instructions in accordance with SUBMITTALS.

3.2.1 Cable Installation Plan and Procedure

Cable shall be installed strictly in accordance with the cable manufacturer's recommendations. Each circuit shall be identified by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole, junction box, and each terminal. Each tag shall contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

3.2.1.1 Cable Inspection

The cable reel shall be inspected for correct storage positions, signs of physical damage, and broken end seals. If end seal is broken, moisture shall be removed from cable in accordance with the cable manufacturer's recommendations.

3.2.1.2 Duct Cleaning

Duct shall be cleaned with an assembly that consists of a flexible mandrel (manufacturers standard product in lengths recommended for the specific size and type of duct) that is 1/4 inch less than inside diameter of duct, 2 wire brushes, and a rag. The cleaning assembly shall be pulled through conduit a minimum of 2 times or until less than a volume of 8 cubic inches of debris is expelled from the duct.

3.2.1.3 Duct Lubrication

The cable lubricant shall be compatible with the cable jacket for cable that is being installed. Application of lubricant shall be in accordance with lubricant manufacturer's recommendations.

3.2.1.4 Cable Installation

The Contractor shall provide a cable feeding truck and a cable pulling winch as required. The Contractor shall provide a pulling grip or pulling eye in accordance with cable manufacturer's recommendations. The pulling grip or pulling eye apparatus shall be attached to polypropylene or manilla rope followed by lubricant front end packs and then by power cables. A dynamometer shall be used to monitor pulling tension. Pulling tension shall not exceed cable manufacturer's recommendations. The Contractor shall not allow cables to cross over while cables are being fed into duct. For cable installation in cold weather, cables shall be kept at 50 degrees F temperature for at least 24 hours before installation.

3.2.1.5 Cable Installation Plan

The Contractor shall submit a cable installation plan for all cable pulls in accordance with the detail drawings portion of paragraph SUBMITTALS. Cable installation plan shall include:

- a. Site layout drawing with cable pulls identified in numeric order of expected pulling sequence and direction of cable pull.

- b. List of cable installation equipment.
- c. Lubricant manufacturer's application instructions.
- d. Procedure for resealing cable ends to prevent moisture from entering cable.
- e. Cable pulling tension calculations of all cable pulls.
- f. Cable percentage conduit fill.
- g. Cable sidewall thrust pressure.
- h. Cable minimum bend radius and minimum diameter of pulling wheels used.
- i. Cable jam ratio.
- j. Maximum allowable pulling tension on each different type and size of conductor.
- k. Maximum allowable pulling tension on pulling device.

3.2.2 Duct Line

Cables shall be installed in duct lines where indicated. Cable splices in low-voltage cables shall be made in manholes and handholes only, except as otherwise noted. Cable joints in medium-voltage cables shall be made in manholes or approved pullboxes only. Neutral and grounding conductors shall be installed in the same duct with their associated phase conductors.

3.3 DUCT LINES

3.3.1 Requirements

Numbers and sizes of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of 4 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells whenever duct lines terminate in manholes or handholes.

3.3.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools

and match factory tapers. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.3.3 Concrete Encasement

Ducts requiring concrete encasements shall comply with NFPA 70, except that electrical duct bank configurations for ducts 6 inches in diameter shall be determined by calculation and as shown on the drawings. The separation between adjacent electric power and communication ducts shall conform to IEEE C2. Duct line encasements shall be monolithic construction. At any point, tops of concrete encasements shall be not less than the cover requirements listed in NFPA 70.

3.3.4 Nonencased Direct-Burial

Top of duct lines shall be below the frost line depth of 48 inches, but not less than 42 inches below finished grade and shall be installed with a minimum of 3 inches of earth around each duct, except that between adjacent electric power and communication ducts, 12 inches of earth is required. Bottoms of trenches shall be smooth and free of stones, soft spots, and sharp objects. Where bottoms of trenches comprise materials other than sand, a 3 inch layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil before installing ducts. The first 6 inch layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in 3 to 6 inch layers.

3.3.5 Duct Line Markers

Duct line markers shall be provided at the ends of long duct line stubouts or for other ducts whose locations are indeterminate because of duct curvature or terminations at completely below-grade structures. In addition to markers, a 5 mil brightly colored plastic tape, not less than 3 inches in width and suitably inscribed at not more than 10 feet on centers with a continuous metallic backing and a corrosion-resistant 1 mil metallic foil core to permit easy location of the duct line, shall be placed approximately 12 inches below finished grade levels of such lines.

3.4 PAD-MOUNTED EQUIPMENT INSTALLATION

Pad-mounted equipment, shall be installed on concrete pads in accordance with the manufacturer's published, standard installation drawings and procedures, except that they shall be modified to meet the requirements of this document. Units shall be installed so that they do not damage equipment or scratch painted or coated surfaces. After installation, surfaces shall be inspected and scratches touched up with a paint or coating provided by the manufacturer especially for this purpose. Three-phase transformers shall be installed with ABC phase sequence. Primary taps shall be set at 100 percent.

3.4.1 Concrete Pads

3.4.1.1 Construction

Concrete pads for pad-mounted electrical equipment shall be poured-in-place. Pads shall be constructed as indicated, except that exact pad dimensions and mounting details are equipment specific and are the responsibility of the Contractor. Tops of concrete pads shall be level and shall project 4 inches above finished paving or grade and sloped to drain. Edges of concrete pads shall have 3/4 inch chamfer. Conduits for primary, secondary, and grounding conductors shall be set in place prior to placement of concrete pads. Where grounding electrode conductors are installed through concrete pads, PVC conduit sleeves shall be installed through the concrete to provide physical protection. To facilitate cable installation and termination, the concrete pad shall be provided with a rectangular hole below the primary and secondary compartments, sized in accordance with the manufacturer's recommended dimensions. Upon completion of equipment installation the rectangular hole shall be filled with masonry grout.

3.4.1.2 Concrete and Reinforcement

Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03300A CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete pad reinforcement shall be in accordance with Section 03200A CONCRETE REINFORCEMENT.

3.4.1.3 Sealing

When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.4.2 Padlocks

Padlocks shall be provided for pad-mounted equipment. Padlocks shall be keyed as directed by the Contracting Officer.

3.5 CONNECTIONS BETWEEN AERIAL AND UNDERGROUND SYSTEMS

Connections between aerial and underground systems shall be made as shown. Underground cables shall be extended up poles in conduit to cable terminations. Conduits shall be secured to the poles by 2-hole galvanized steel pipe straps spaced not more than 10 feet apart and with 1 strap not more than 12 inches from any bend or termination. Cable guards shall be secured to poles in accordance with the manufacturer's published procedures. Conduits shall be equipped with bushings to protect cables and minimize water entry. Capnut potheads shall be used to terminate medium-voltage multiple-conductor cable. Cables shall be supported by devices separate from the conduit or guard, near their point of exit from the conduit or guard.

3.6 CONNECTIONS TO BUILDINGS

Cables shall be extended into the various buildings as indicated, and shall be connected to the first applicable termination point in each building. Interfacing with building interior conduit systems shall be at conduit stubouts terminating 5 feet outside of a building and below finished grade as specified and provided under Section 16402 INTERIOR DISTRIBUTION SYSTEM.

After installation of cables, conduits shall be sealed with caulking compound to prevent entrance of moisture or gases into buildings.

3.7 GROUNDING

A ground ring consisting of the indicated configuration of bare copper conductors and driven ground rods shall be around pad-mounted equipment as shown. Equipment frames of metal-enclosed equipment, and other noncurrent-carrying metal parts, such as cable shields, cable sheaths and armor, and metallic conduit shall be grounded. At least 2 connections shall be provided from a transformer, to the ground mat. Metallic frames and covers of handholes and pull boxes shall be grounded by use of a braided, copper ground strap with equivalent ampacity of No. 6 AWG.

3.7.1 Grounding Electrodes

Grounding electrodes shall be installed as shown on the drawings and as follows:

- a. Driven rod electrodes - Unless otherwise indicated, ground rods shall be driven into the earth until the tops of the rods are approximately 1 foot below finished grade.
- b. Ground ring - A ground ring shall be installed as shown consisting of bare copper conductors installed 12 inches, plus or minus 3 inches, below finished top of soil grade. Ground ring conductors shall be sized as shown.
- c. Additional electrodes - When the required ground resistance is not met, additional electrodes shall be provided interconnected with grounding conductors to achieve the specified ground resistance. The additional electrodes will be up to three, 10 foot rods spaced a minimum of 10 feet apart 5/8 inch diameter, driven perpendicular to grade. In high ground resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately.

3.7.2 Grounding and Bonding Connections

Connections above grade shall be made by the fusion-welding process or with bolted solderless connectors, in compliance with UL 467, and those below grade shall be made by a fusion-welding process. Where grounding conductors are connected to aluminum-composition conductors, specially treated or lined copper-to-aluminum connectors suitable for this purpose shall be used.

3.7.3 Grounding and Bonding Conductors

Grounding and bonding conductors include conductors used to bond transformer enclosures and equipment frames to the grounding electrode system. Grounding and bonding conductors shall be sized as shown, and located to provide maximum physical protection. Bends greater than 45 degrees in ground conductors are not permitted. Routing of ground conductors through concrete shall be avoided. When concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground conductor, and the opening shall be sealed with a suitable compound after installation.

3.7.4 Riser Pole Grounding

A single continuous vertical grounding electrode conductor shall be installed on each riser pole and connected directly to the grounding electrodes indicated on the drawings or required by these specifications. All equipment, neutrals, surge arresters, and items required to be grounded shall be connected directly to this vertical conductor. The grounding electrode conductor shall be sized as shown. Grounding electrode conductors shall be stapled to wood poles at intervals not exceeding 2 feet.

3.8 FIELD TESTING

3.8.1 General

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 7 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. Field test reports shall be signed and dated by the Contractor.

3.8.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.8.3 Ground-Resistance Tests

The resistance of each grounding electrode system shall be measured using the fall-of-potential method defined in IEEE Std 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded

together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- a. Single rod electrode - 25 ohms.
- b. Multiple rod electrodes - 25 ohms.
- c. Ground ring - 25 ohms.

3.8.4 Ground-Mat Connection Inspection

All below-grade ground-mat connections will be visually inspected by the Contracting Officer before backfilling. The Contractor shall notify the Contracting Officer 24 hours before the site is ready for inspection.

3.8.5 Medium-Voltage Cable Test

After installation and before the operating test or connection to an existing system, the medium-voltage cable system shall be given a high potential test. Direct-current voltage shall be applied on each phase conductor of the system by connecting conductors as one terminal and connecting grounds or metallic shieldings or sheaths of the cable as the other terminal for each test. Prior to making the test, the cables shall be isolated by opening applicable protective devices and disconnecting equipment. The test shall be conducted with all splices, connectors, and terminations in place. The method, voltage, length of time, and other characteristics of the test for initial installation shall be in accordance with NEMA WC 7 or NEMA WC 8 for the particular type of cable installed, except that 28 kV and 35 kV insulation test voltages shall be in accordance with either AEIC CS5 or AEIC CS6 as applicable, and shall not exceed the recommendations of IEEE Std 404 for cable joints and IEEE Std 48 for cable terminations unless the cable and accessory manufacturers indicate higher voltages are acceptable for testing. Should any cable fail due to a weakness of conductor insulation or due to defects or injuries incidental to the installation or because of improper installation of cable, cable joints, terminations, or other connections, the Contractor shall make necessary repairs or replace cables as directed. Repaired or replaced cables shall be retested.

3.8.6 Liquid-Filled Transformer Tests

The following field tests shall be performed on all liquid-filled transformers. Pass-fail criteria shall be in accordance with transformer manufacturer's specifications.

- a. Insulation resistance test phase-to-ground.
- b. Turns ratio test.
- c. Correct phase sequence.
- d. Correct operation of tap changer.

3.8.7 Pre-Energization Services

Calibration, testing, adjustment, and placing into service of the installation shall be accomplished by a manufacturer's product field service engineer or independent testing company with a minimum of 2 years of current product experience. The following services shall be performed on the equipment listed below. These services shall be performed subsequent to testing but prior to the initial energization. The equipment shall be inspected to ensure that installation is in compliance with the recommendations of the manufacturer and as shown on the detail drawings. Terminations of conductors at major equipment shall be inspected to ensure the adequacy of connections. Bare and insulated conductors between such terminations shall be inspected to detect possible damage during installation. If factory tests were not performed on completed assemblies, tests shall be performed after the installation of completed assemblies. Components shall be inspected for damage caused during installation or shipment to ensure packaging materials have been removed. Components capable of being both manually and electrically operated shall be operated manually prior to the first electrical operation. Components capable of being calibrated, adjusted, and tested shall be calibrated, adjusted, and tested in accordance with the instructions of the equipment manufacturer. Items for which such services shall be provided, but are not limited to, are the following:

- a. Pad-mounted transformers

3.8.8 Operating Tests

After the installation is completed, and at such times as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the requirements herein. An operating test report shall be submitted in accordance with paragraph SUBMITTALS.

-- End of Section --

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SECTION 16402

INTERIOR DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 1	(2001) Hard-Drawn Copper Wire
ASTM B 8	(1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D 709	(2001) Laminated Thermosetting Materials

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA TIA/EIA-568-B.1	(2001; Addendum 2001) Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements (ANSI/TIA/EIA-568-B.1)
EIA TIA/EIA-569-A	(1998; Addenda 2000, 2001) Commercial Building Standards for Telecommunications Pathways and Spaces (ANSI/TIA/EIA-569-A)
TIA J-STD-607-A	(2002) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2002) National Electrical Safety Code (IEEE)
IEEE Std 100	(2000) Dictionary of Electrical and Electronics Terms (IEEE)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2003) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA C12.1	(2001) Electric Meters; Code for Electricity Metering

NEMA C80.1	(1994) Rigid Steel Conduit - Zinc Coated
NEMA C80.3	(1994) Electrical Metallic Tubing - Zinc Coated (EMT)
NEMA FU 1	(2002) Low Voltage Cartridge Fuses
NEMA ICS 1	(2000) Industrial Control and Systems General Requirements
NEMA ICS 2	(2000) Industrial Control and Systems Controllers, Contactors, and Overload Relays, Rated 600 Volts
NEMA ICS 4	(2000) Industrial Control and Systems: Terminal Blocks
NEMA ICS 6	(1993; R 2001) Industrial Control and Systems , Enclosures
NEMA KS 1	(2001) Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
NEMA MG 1	(2003) Motors and Generators
NEMA MG 10	(2001) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors
NEMA MG 11	(2001) Energy Management Guide for Selection and Use of Single-Phase Motors
NEMA RN 1	(1998) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA ST 20	(1992; R 1997) Dry-Type Transformers for General Applications
NEMA TC 2	(2003) Electrical Polyvinyl Chloride (PVC) Tubing and Conduit
NEMA TC 3	(2004) Polyvinyl Chloride PVC Fittings for Use with Rigid PVC Conduit and Tubing
NEMA TP 1	(2002) Guide for Determining Energy Efficiency for Distribution Transformers
NEMA WD 1	(1999) General Color Requirements for Wiring Devices
NEMA WD 6	(2002) Wiring Devices - Dimensional

Specifications

NEMA Z535.4	(2002) Product Safety Signs and Labels
INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)	
NETA ATS	(1999) Electrical Power Distribution Equipment and Systems
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 70	(2002) National Electrical Code
NFPA 70E	(2000) Electrical Safety Requirements for Employee Workplaces
UNDERWRITERS LABORATORIES (UL)	
UL 1	(2000; Rev thru Mar 2004) Flexible Metal Conduit
UL 6	(2000; Bul. 2001, 2002) Rigid Metal Conduit - Steel
UL 20	(2000; R 2002, Bul. 2002) General-Use Snap Switches
UL 44	(1999; R 2002, Bul. 2002) Thermoset-Insulated Wires and Cables
UL 50	(1995; R 1999, Bul. 2001) Enclosures for Electrical Equipment
UL 67	(1993; R 2002) Panelboards
UL 83	(1998; R 2001, Bul. 2002) Thermoplastic-Insulated Wires and Cables
UL 198E	(1988; R 1988) Class R Fuses
UL 360	(1996; R 2001, Bul. 2002) Liquid-Tight Flexible Steel Conduit
UL 486A	(1997; R 2001, Bul. 2002, 2003) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486C	(2000; R 2002) Splicing Wire Connectors
UL 489	(2002; R 2002, Bul. 2003) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 498	(2001; R 2002) Attachment Plugs and

Receptacles

UL 508	(1999; R 2002, Bul. 2003) Industrial Control Equipment
UL 510	(1994; R 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 512	(1993; R 1999) Fuseholders
UL 514A	(1996; R 2001, Bul. 2002) Metallic Outlet Boxes
UL 514B	(1997; R 2002, Bul. 2002) Fittings for Cable and Conduit
UL 514C	(1996; R 2002) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 651	(1995; R 2002) Schedule 40 and 80 Rigid PVC Conduit
UL 674	(1994; Rev thru Oct 1998) Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations
UL 698	(1995; Rev thru Mar 1999) Industrial Control Equipment for Use in Hazardous (Classified) Locations
UL 797	(2000; Bul. 2002) Electrical Metallic Tubing
UL 817	(1994); Rev thru May 1999) Cord Sets and Power Supply Cords
UL 869A	(1998; Bul. 2002) Reference Standard for Service Equipment
UL 870	(1995; R 1999, Bul. 2002) Wireways, Auxiliary Gutters, and Associated Fittings
UL 877	(1993; Rev thru Nov 1999) Circuit Breakers and Circuit-Breaker Enclosures for Use in Hazardous (Classified) Locations
UL 886	(1994; R 1999, Bul. 2002) Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations
UL 943	(1993; R 2002, Bul. 2002) Ground-Fault Circuit-Interrupters
UL 984	(1996, Bul. 2001) Hermetic Refrigerant

Motor-Compressors

UL 1010	(1995; R 1999, Bul. 2002) Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations
UL 1063	(1993; Rev. thru Oct 1994) Machine-Tool Wire and Cables
UL 1242	(2000; Rev thru May 2003) Electrical Intermediate Metal Conduit -- Steel
UL 1449	(1996; R 2002) Transient Voltage Surge Suppressors

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.147	Control of Hazardous Energy (Lock Out/Tag Out)
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1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE Std 100.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are[for Contractor Quality Control approval][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government]. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Panelboards; G

Transformers; G

Cable trays; G

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

SD-03 Product Data

Receptacles; G]

Circuit breakers; G

Switches; G

Transformers; G

Motor controllers; G

Combination motor controllers; G

Manual motor starters; G

Metering; G

CATV outlets; G

Telecommunications Grounding Busbar; G

Surge protective devices; G

Submittals shall include performance and characteristic curves.

SD-06 Test Reports

600-volt wiring test; G

Grounding system test; G

Transformer tests; G

SD-07 Certificates

Fuses; G

SD-09 Manufacturer's Field Reports

Transformer factory tests

[SD-10 Operation and Maintenance Data

Electrical Systems, Data Package 5; G

[Metering, Data Package 5; G

Submit operation and maintenance data in accordance with Section 01781, OPERATION AND MAINTENANCE DATA and as specified herein.

]1.4 QUALITY ASSURANCE

1.4.1 Fuses

Submit coordination data as specified in paragraph, FUSES of this section.

1.4.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.5 MAINTENANCE

1.5.1 Electrical Systems

Submit operation and maintenance manuals for electrical systems that provide basic data relating to the design, operation, and maintenance of the electrical distribution system for the building. This shall include:

- a. Single line diagram of the "as-built" building electrical system.
- b. Schematic diagram of electrical control system (other than HVAC, covered elsewhere).

1.6 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials, equipment, and devices shall, as a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70.

2.2 CONDUIT AND FITTINGS

Shall conform to the following:

2.2.1 Rigid Metallic Conduit

2.2.1.1 Rigid, Threaded Zinc-Coated Steel Conduit

NEMA C80.1, UL 6.

2.2.2 Rigid Nonmetallic Conduit

PVC Type EPC-40 in accordance with NEMA TC 2, UL 651.

2.2.3 Intermediate Metal Conduit (IMC)

UL 1242, zinc-coated steel only.

2.2.4 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797, NEMA C80.3.

2.2.5 Plastic-Coated Rigid Steel and IMC Conduit

NEMA RN 1, Type 40(40 mils thick).

2.2.6 Flexible Metal Conduit

UL 1.

2.2.6.1 Liquid-Tight Flexible Metal Conduit, Steel

UL 360.

2.2.7 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit

UL 514B. Ferrous fittings shall be cadmium- or zinc-coated in accordance with UL 514B.

2.2.7.1 Fittings for Rigid Metal Conduit and IMC

Threaded-type. Split couplings unacceptable.

2.2.7.2 Fittings for EMT

Steel compression type.

2.2.8 Fittings for Rigid Nonmetallic Conduit

NEMA TC 3 for PVC, and UL 514B.

2.3 OUTLET BOXES AND COVERS

UL 514A, cadmium- or zinc-coated, if ferrous metal. UL 514C, if nonmetallic.

2.3.1 Outlet Boxes for Telecommunications System

Provide standard type 4 inches square by 2 1/8 inches deep. Depth of boxes shall be large enough to allow manufacturers' recommended conductor bend radii.

2.4 CABINETS, JUNCTION BOXES, AND PULL BOXES

Volume greater than 100 cubic inches, UL 50, hot-dip, zinc-coated, if sheet steel.

2.5 WIRES AND CABLES

Wires and cables shall meet applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Wires and cables manufactured more than 12 months prior to date of delivery to site shall not be used.

2.5.1 Conductors

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and ampacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.

2.5.1.1 Equipment Manufacturer Requirements

When manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to satisfy manufacturer's requirements.

2.5.1.2 Minimum Conductor Sizes

Minimum size for branch circuits shall be No. 12 AWG; for Class 1 remote-control and signal circuits, No. 14 AWG; for Class 2 low-energy, remote-control and signal circuits, No. 16 AWG; and for Class 3 low-energy,

remote-control, alarm and signal circuits, No. 22 AWG.

2.5.2 Color Coding

Provide for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals shall be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems shall be as follows:

a. 208/120 volt, three-phase

- (1) Phase A - black
- (2) Phase B - red
- (3) Phase C - blue

b. 480/277 volt, three-phase

- (1) Phase A - brown
- (2) Phase B - orange
- (3) Phase C - yellow

2.5.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN/THHN conforming to UL 83, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be Type TW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

2.5.4 Bonding Conductors

ASTM B 1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B 8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.5.4.1 Telecommunications Bonding Backbone (TBB)

Provide a copper conductor TBB in accordance with TIA J-STD-607-A. The TBB shall be a minimum No. 6 AWG and be sized at 2 kcmil per linear foot of conductor length up to a maximum size of 3/0 AWG.

2.5.4.2 Bonding Conductor for Telecommunications

Provide a copper conductor Bonding Conductor for Telecommunications between the telecommunications main grounding busbar (TMGB) and the electrical service ground in accordance with TIA J-STD-607-A. The bonding conductor for telecommunications shall be sized the same as the TBB.

2.5.5 Cord Sets and Power-Supply Cords

UL 817.

]2.6 SPLICES AND TERMINATION COMPONENTS

UL 486A for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires shall be insulated, pressure-type in accordance with UL 486A or UL 486C (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

2.7 DEVICE PLATES

Provide UL listed, one-piece device plates for outlets to suit the devices installed. For metal outlet boxes, plates on unfinished walls shall be of zinc-coated sheet steel or cast metal having round or beveled edges. Plates on finished walls shall be nylon or lexan, minimum 0.03 inch wall thickness. Plates shall be same color as receptacle or toggle switch with which they are mounted. Screws shall be machine-type with countersunk heads in color to match finish of plate. Sectional type device plates will not be permitted. Plates installed in wet locations shall be gasketed and UL listed for "wet locations."

2.8 SWITCHES

2.8.1 Toggle Switches

NEMA WD 1, UL 20, single pole, three-way, and four-way, totally enclosed with bodies of thermoplastic or thermoset plastic and mounting strap with grounding screw. Handles shall be white thermoplastic. Wiring terminals shall be screw-type, side-wired. Contacts shall be silver-cadmium and contact arm shall be one-piece copper alloy. Switches shall be rated quiet-type ac only, 120/277 volts, with current rating and number of poles indicated.

2.8.2 Switch with Red Pilot Handle

NEMA WD 1. Provide pilot lights that are integrally constructed as a part of the switch's handle. The pilot light shall be red and shall illuminate whenever the switch is closed or "on". The pilot lighted switch shall be rated 20 amps and 120 volts or 277 volts as indicated. Provide the circuit's neutral conductor to each switch with a pilot light.

2.8.3 Breakers Used as Switches

For 120- and 277-Volt fluorescent fixtures, mark breakers "SWD" in accordance with UL 489.

2.8.4 Disconnect Switches

NEMA KS 1. Provide heavy duty-type switches where indicated, where switches are rated higher than 240 volts, and for double-throw switches. Fused switches shall utilize Class R fuseholders and fuses, unless

indicated otherwise. Switches serving as motor-disconnect means shall be horsepower rated. Provide switches in NEMA, enclosure as indicated per NEMA ICS 6.

2.9 FUSES

NEMA FU 1. Provide complete set of fuses for each fusible switch. Time-current characteristics curves of fuses serving motors or connected in series with circuit breakers[or other circuit protective devices] shall be coordinated for proper operation. Submit coordination data for approval. Fuses shall have voltage rating not less than circuit voltage.

2.9.1 Fuseholders

Provide in accordance with UL 512.

2.9.2 Cartridge Fuses, Current Limiting Type (Class R)

UL 198E, Class RK-5. Associated fuseholders shall be Class R only.

2.10 RECEPTACLES

UL 498, hard use, heavy-duty, grounding-type. Ratings and configurations shall be as indicated. Bodies shall be of white as per NEMA WD 1. Face and body shall be thermoplastic supported on a metal mounting strap. Dimensional requirements shall be per NEMA WD 6. Provide screw-type, side-wired wiring terminals. Connect grounding pole to mounting strap. The receptacle shall contain triple-wipe power contacts and double or triple-wipe ground contacts.

2.10.1 Weatherproof Receptacles

Provide in cast metal box with gasketed, weatherproof, cast-metal cover plate and gasketed cap over each receptacle opening. Provide caps with a spring-hinged flap. Receptacle shall be UL listed for use in "wet locations with plug in use."

2.10.2 Ground-Fault Circuit Interrupter Receptacles

UL 943, duplex type for mounting in standard outlet box. Device shall be capable of detecting current leak of 6 milliamperes or greater and tripping per requirements of UL 943 for Class A GFI devices. Provide screw-type, side-wired wiring terminals or pre-wired (pigtail) leads.

2.10.3 Plugs

Provide heavy-duty, rubber-covered cord of required size, install plugs thereon, and attach to equipment. Plugs shall be UL listed with receptacles, complete with grounding blades. Where equipment is not available, turn over plugs and cord assemblies to the Government.

2.10.4 Range Receptacles

NEMA 14-50 configuration, flush mounted rated 50 amperes, 125/250 volts.

Furnish one matching plug with each receptacle.

2.11 PANELBOARDS

UL 67 and UL 50 having a short-circuit current rating as indicated. Panelboards for use as service disconnecting means shall additionally conform to UL 869A. Panelboards shall be circuit breaker-equipped[unless indicated otherwise]. Design shall be such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL. "Specific breaker placement" is required in panelboards to match the breaker placement indicated in the panelboard schedule on the drawings. Use of "Subfeed Breakers" is not acceptable unless specifically indicated otherwise. Main breaker shall be "separately" mounted "above" or "below" branch breakers. Where "space only" is indicated, make provisions for future installation of breakers. Directories shall indicate load served by each circuit in panelboard. Directories shall also indicate source of service to panelboard (e.g., Panel PA served from Panel MDP). Type directories and mount in holder behind transparent protective covering. Panelboards shall be listed and labeled for their intended use. Panelboard shall have nameplates in accordance with paragraph FIELD FABRICATED NAMEPLATES.

2.11.1 Enclosure

Enclosures shall meet the requirements of UL 50. All cabinets shall be fabricated from sheet steel of not less than No. 10 gauge if flush-mounted or mounted outdoors, and not less than No. 12 gauge if surface-mounted indoors, with full seam-welded box ends. Cabinets mounted outdoors or flush-mounted shall be hot-dipped galvanized after fabrication. Cabinets shall be painted in accordance with paragraph PAINTING. Outdoor cabinets shall be of NEMA 3R raintight with conduit hubs welded to the cabinet. Front edges of cabinets shall be form-flanged or fitted with structural shapes welded or riveted to the sheet steel, for supporting the panelboard front. All cabinets shall be so fabricated that no part of any surface on the finished cabinet shall deviate from a true plane by more than 1/8 inch.

Holes shall be provided in the back of indoor surface-mounted cabinets, with outside spacers and inside stiffeners, for mounting the cabinets with a 1/2 inch clear space between the back of the cabinet and the wall surface.

Flush doors shall be mounted on hinges that expose only the hinge roll to view when the door is closed. Each door shall be fitted with a combined catch and lock, except that doors over 24 inches long shall be provided with a three-point latch having a knob with a T-handle, and a cylinder lock. Two keys shall be provided with each lock, and all locks shall be keyed alike. Finished-head cap screws shall be provided for mounting the panelboard fronts on the cabinets.

2.11.2 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Main buses and back pans shall be designed so that breakers may be changed without machining, drilling, or tapping. Provide isolated neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus per UL 67 for connecting

grounding conductors; bond to steel cabinet.

2.11.2.1 Panelboard Neutrals for Non-Linear Loads

UL listed, and panelboard type shall have been specifically UL heat rise tested for use on non-linear loads. Panelboard shall be heat rise tested in accordance with UL 67, except with the neutral assembly installed and carrying 200 percent of the phase bus current during testing. Verification of the testing procedure shall be provided upon request. Two neutral assemblies paralleled together with cable is not acceptable. Nameplates for panelboard rated for use on non-linear loads shall be marked "SUITABLE FOR NON-LINEAR LOADS" and shall be in accordance with paragraph FIELD FABRICATED NAMEPLATES. Provide a neutral label with instructions for wiring the neutral of panelboards rated for use on non-linear loads.

2.11.3 Circuit Breakers

UL 489, thermal magnetic-type having a minimum short-circuit current rating equal to the short-circuit current rating of the panelboard in which the circuit breaker shall be mounted. Breaker terminals shall be UL listed as suitable for type of conductor provided. Where indicated on the drawings, provide circuit breakers with shunt trip devices. Series rated circuit breakers and plug-in circuit breakers are unacceptable.

2.11.3.1 Multipole Breakers

Provide common trip-type with single operating handle. Breaker design shall be such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C, respectively.

2.11.3.2 Circuit Breaker With GFI

UL 943 and NFPA 70. Provide with "push-to-test" button, visible indication of tripped condition, and ability to detect and trip on current imbalance of 6 milliamperes or greater per requirements of UL 943 for Class A GFI devices, for personnel protection, and 20 milliamperes or greater per requirements of UL 943 for Class B GFI per equipment protection.

2.11.3.3 Circuit Breakers for HVAC Equipment

Circuit breakers for HVAC equipment having motors (group or individual) shall be marked for use with HACR type and UL listed as HACR type.

2.12 ENCLOSED CIRCUIT BREAKERS

UL 489. Individual molded case circuit breakers with voltage and continuous current ratings, number of poles, overload trip setting, and short circuit current interrupting rating as indicated. Enclosure type as indicated. Provide solid neutral.

2.13 MOTOR SHORT-CIRCUIT PROTECTOR (MSCP)

Motor short-circuit protectors, also called motor circuit protectors

(MCPs); shall conform to UL 508 and UL 489 and shall be provided as shown. MSCPs shall consist of an adjustable instantaneous trip circuit breaker used only in conjunction with a combination motor controller which provides coordinated motor branch-circuit overload and short-circuit protection. MSCPs shall be rated in accordance with the requirements of NFPA 70.

2.14 TRANSFORMERS

NEMA ST 20, general purpose, dry-type, self-cooled, ventilated. Provide transformers in NEMA 1 enclosure. Transformer shall have 220 degrees C insulation system for transformers 15 kVA and greater, and shall have 180 degrees C insulation for transformers rated 10 kVA and less, with temperature rise not exceeding 150 degrees C under full-rated load in maximum ambient of 40 degrees C. Transformer of 150 degrees C temperature rise shall be capable of carrying continuously 100 percent of nameplate kVA without exceeding insulation rating. Transformers shall be quiet type with maximum sound level at least 3 decibels less than NEMA standard level for transformer ratings indicated.

2.14.1 Specified Transformer Efficiency

Transformers, indicated and specified with: 480V primary, 80 degrees C or 115 degrees C temperature rise, kVA ratings of 37.5 to 100 for single phase or 30 to 500 for three phase, shall be energy efficient type. Minimum efficiency, based on factory test results, shall not be less than NEMA Class 1 efficiency as defined by NEMA TP 1.

2.15 MOTORS

NEMA MG 1 FIRE PUMPS; hermetic-type sealed motor compressors shall also comply with UL 984. Provide the size in terms of HP, or kVA, or full-load current, or a combination of these characteristics, and other characteristics, of each motor as indicated or specified. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters. Motors for operation on 208-volt, 3-phase circuits shall have terminal voltage rating of 200 volts, and those for operation on 480-volt, 3-phase circuits shall have terminal voltage rating of 460 volts. Motors shall be designed to operate at full capacity with voltage variation of plus or minus 10 percent of motor voltage rating. Unless otherwise indicated, motors rated 1 HP and above shall be continuous duty type.

Where fuse protection is specifically recommended by the equipment manufacturer, provide fused switches in lieu of non-fused switches indicated.

2.15.1 High Efficiency Single-Phase Motors

Single-phase fractional-horsepower alternating-current motors shall be high efficiency types corresponding to the applications listed in NEMA MG 11. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.15.2 Premium Efficiency Polyphase Motors

Polyphase motors shall be selected based on high efficiency characteristics relative to typical characteristics and applications as listed in NEMA MG 10.

In addition, continuous rated, polyphase squirrel-cage medium induction motors shall meet the requirements for premium efficiency electric motors in accordance with NEMA MG 1, including the NEMA full load efficiency ratings. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.15.3 Motor Sizes

Provide size for duty to be performed, not exceeding the full-load nameplate current rating when driven equipment is operated at specified capacity under most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, make adjustments to wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay.

2.15.4 Wiring and Conduit

Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide power wiring and conduit for field-installed equipment, and motor control equipment forming part of motor control centers or switchgear assemblies, the conduit and wiring connecting such centers, assemblies, or other power sources to equipment as specified herein. Power wiring and conduit shall conform to the requirements specified herein. Control wiring shall be provided under, and conform to the requirements of the section specifying the associated equipment.

2.16 MOTOR CONTROLLERS

UL 508, NEMA ICS 1, and NEMA ICS 2, Controllers shall have thermal overload protection in each phase and shall have one spare normally open and one spare normally closed auxiliary contact. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay. Magnetic-type motor controllers shall have undervoltage protection when used with momentary-contact pushbutton stations or switches and shall have undervoltage release when used with maintained-contact pushbutton stations or switches. When used with pressure, float, or similar automatic-type or maintained-contact switch, controller shall have hand/off/automatic selector switch. Connections to selector switch shall be such that only normal automatic regulatory control devices are bypassed when switch is in "hand" position. Safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices, shall be connected in motor control circuit in "hand" and "automatic" positions. Control circuit connections to

hand/off/automatic selector switch or to more than one automatic regulatory control device shall be made in accordance with indicated or manufacturer's approved wiring diagram. For each motor not in sight of controller or where controller disconnecting means is not in sight of motor location and driven machinery location, controller disconnecting means shall be capable of being locked in open position. As an alternative, provide a manually operated, lockable, nonfused switch which disconnects motor from supply source within sight of motor. Overload protective devices shall provide adequate protection to motor windings; be thermal inverse-time-limit type; and include manual reset-type pushbutton on outside of motor controller case. Cover of combination motor controller and manual switch or circuit breaker shall be interlocked with operating handle of switch or circuit breaker so that cover cannot be opened unless handle of switch or circuit breaker is in "off" position. Minimum short circuit withstand rating of combination motor controller shall be 10,000 rms symmetrical amperes. Provide controllers in hazardous locations with classifications as required by code.

2.16.1 Control Wiring

All control wire shall be stranded tinned copper switchboard wire with 600-volt flame-retardant insulation Type SIS meeting UL 44, or Type MTW meeting UL 1063, and shall pass the VW-1 flame tests included in those standards. Hinge wire shall have Class K stranding. Current transformer secondary leads shall be not smaller than No. 10 AWG. The minimum size of control wire shall be No. 14 AWG. Power wiring for 480-volt circuits and below shall be of the same type as control wiring and the minimum size shall be No. 12 AWG. Special attention shall be given to wiring and terminal arrangement on the terminal blocks to permit the individual conductors of each external cable to be terminated on adjacent terminal points.

2.16.2 Control Circuit Terminal Blocks

NEMA ICS 4. Control circuit terminal blocks for control wiring shall be molded or fabricated type with barriers, rated not less than 600 volts. The terminals shall be removable binding, fillister or washer head screw type, or of the stud type with contact and locking nuts. The terminals shall be not less than No. 10 in size and shall have sufficient length and space for connecting at least two indented terminals for 10 AWG conductors to each terminal. The terminal arrangement shall be subject to the approval of the Contracting Officer and not less than four (4) spare terminals or 10 percent, whichever is greater, shall be provided on each block or group of blocks. Modular, pull apart, terminal blocks will be acceptable provided they are of the channel or rail-mounted type. The Contractor shall submit data showing that the proposed alternate will accommodate the specified number of wires, are of adequate current-carrying capacity, and are constructed to assure positive contact between current-carrying parts.

2.16.2.1 Types of Terminal Blocks

- a. Short-Circuiting Type: Short-circuiting type terminal blocks shall be furnished for all current transformer secondary leads and

shall have provision for shorting together all leads from each current transformer without first opening any circuit. Terminal blocks shall meet the requirements of paragraph CONTROL CIRCUIT TERMINAL BLOCKS above.

- b. Load Type: Load terminal blocks rated not less than 600 volts and of adequate capacity shall be provided for the conductors for NEMA Size 3 and smaller motor controllers and for other power circuits, except those for feeder tap units. The terminals shall be of either the stud type with contact nuts and locking nuts or of the removable screw type, having length and space for at least two indented terminals of the size required on the conductors to be terminated. For conductors rated more than 50 amperes, screws shall have hexagonal heads. Conducting parts between connected terminals shall have adequate contact surface and cross-section to operate without overheating. Each connected terminal shall have the circuit designation or wire number placed on or near the terminal in permanent contrasting color.

2.16.3 Control Circuits

Control circuits shall have maximum voltage of 120 volts derived from a separate control source. Provide terminals and terminal boards. Provide separate control disconnect switch within controller. One secondary lead shall be fused; other shall be grounded.

2.16.4 Enclosures for Motor Controllers

NEMA ICS 6.

2.16.5 Multiple-Speed Motor Controllers and Reversible Motor Controllers

Across-the-line-type, electrically and mechanically interlocked. Multiple-speed controllers shall have compelling relays and shall be multiple-button, station-type with pilot lights for each speed.

2.16.6 Pushbutton Stations

Provide with "start/stop" momentary contacts having one normally open and one normally closed set of contacts, and red lights to indicate when motor is running. Stations shall be heavy duty, oil-tight design.

2.16.7 Pilot and Indicating Lights

Provide LED cluster lamps.

2.17 MANUAL MOTOR STARTERS (MOTOR RATED SWITCHES)

Single or double pole designed for surface mounting with overload protection[and pilot lights].

2.17.1 Pilot Lights

Provide yoke-mounted, seven element LED cluster light module. Color shall

be green and red in accordance with NEMA ICS 2.

2.18 LOCKOUT REQUIREMENTS

Provide disconnecting means capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147. Mechanical isolation of machines and other equipment shall be in accordance with requirements of Division 15, "Mechanical."

2.19 TELECOMMUNICATIONS SYSTEM

Provide system of telecommunications wire-supporting structures (pathway), including: outlet boxes, conduits with pull wires wireways, and other accessories for telecommunications outlets and pathway in accordance with EIA TIA/EIA-569-A and as specified herein. Additional telecommunications requirements are specified in Section 16710, BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.20 COMMUNITY ANTENNA TELEVISION (CATV) SYSTEM

Additional CATV requirements are specified in Section 16815A, CABLE TELEVISION PREMISES DISTRIBUTION SYSTEM.

2.20.1 CATV Outlets

Provide flush mounted, 75-ohm, F-type connector outlet rated from 5 to 1000 MHz in standard electrical outlet boxes[with isolation barrier] with mounting frame.

2.20.2 CATV Faceplates

Provide modular faceplates for mounting of CATV Outlets. Faceplate shall include designation labels and label covers for circuit identification. Faceplate color shall match outlet and switch coverplates.

[2.20.3 Backboards

Coordinate CATV backboard requirements with telecommunications backboard requirements as specified in Section 16710, BUILDING TELECOMMUNICATIONS CABLING.

2.21 GROUNDING AND BONDING EQUIPMENT

2.21.1 Ground Bus

A copper ground bus shall be provided in the electrical equipment rooms as indicated.

2.21.2 Telecommunications and CATV Grounding Busbar

Provide corrosion-resistant grounding busbar suitable for indoor installation in accordance with TIA J-STD-607-A. Busbars shall be electrotin-plated for reduced contact resistance. If not plated, the

busbar shall be cleaned prior to fastening the conductors to the busbar, and an anti-oxidant shall be applied to the contact area to control corrosion and reduce contact resistance. Provide a telecommunications main grounding busbar (TMGB) in the telecommunications entrance facility. The telecommunications main grounding busbar (TMGB) shall be sized in accordance with the immediate application requirements and with consideration of future growth. Provide telecommunications grounding busbars with the following:

- a. Predrilled copper busbar provided with holes for use with standard sized lugs,
- b. Minimum dimensions of 0.25 in thick x 4 in wide for the TMGB[and 2 in wide for TGBs] with length as indicated;
- c. Listed by a nationally recognized testing laboratory.

2.22 HAZARDOUS LOCATIONS

Electrical materials, equipment, and devices for installation in hazardous locations, as defined by NFPA 70, shall be specifically approved by Underwriters' Laboratories, Inc., or Factory Mutual for particular "Class," "Division," and "Group" of hazardous locations involved. Boundaries and classifications of hazardous locations shall be as indicated. Equipment in hazardous locations shall comply with UL 877 for circuit breakers, UL 886 for outlet boxes and fittings, UL 1010 for receptacles, UL 674 for motors, and UL 698 for industrial controls.

2.23 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.24 FIELD FABRICATED NAMEPLATES

ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

2.25 WARNING SIGNS

Provide warning signs for flash protection in accordance with NFPA 70E and NEMA Z535.4 for switchboards, panelboards, industrial control panels, and motor control centers that are in other than dwelling occupancies and are likely to require examination, adjustment, servicing, or maintenance while energized. Provide field installed signs to warn qualified persons of potential electric arc flash hazards when warning signs are not provided by

the manufacturer. The marking shall be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

2.26 FIRESTOPPING MATERIALS

Provide firestopping around electrical penetrations in accordance with Section 07840, FIRESTOPPING .

2.27 WIREWAYS

UL 870. Material shall be steel epoxy painted 16 gauge for heights and depths up to 6 by 6 inches, and 14 gauge for heights and depths up to 12 by 12 inches. Provide in length[indicated][required for the application] with hinged-cover NEMA 1 enclosure per NEMA ICS 6.

2.28 SURGE PROTECTIVE DEVICES

Provide parallel type surge protective devices which comply with UL 1449 at the service entrance. Provide surge protectors in a NEMA 1 enclosure per NEMA ICS 6. Provide the following modes of protection:

FOR SINGLE PHASE AND THREE PHASE WYE CONNECTED SYSTEMS-

Each phase to neutral (L-N)

Neutral to ground (N-G)

Phase to ground (L-G)

Surge protective devices at the service entrance shall have a minimum surge current rating of 80,000 amperes per mode minimum. The maximum line to neutral (L-N) Suppressed Voltage Rating (SVR) shall be:

The minimum MCOV (Maximum Continuous Operating Voltage) rating shall be 300/150V for 208Y/120V, three phase system.

EMI/RFI filtering shall be provided for each mode with the capability to attenuate high frequency noise. Minimum attenuation shall be 20db.

2.29 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test and the additional requirements as specified herein. Interior and exterior steel surfaces of equipment enclosures shall be thoroughly cleaned and then receive a rust-inhibitive phosphatizing or equivalent treatment prior to painting. Exterior surfaces shall be free from holes, seams, dents, weld marks, loose scale or other imperfections. Interior surfaces shall receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice. Exterior surfaces shall be primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish. Equipment located indoors shall be ANSI Light Gray,[and equipment located outdoors shall be Fed Spec 23578 Antique Linen. Provide manufacturer's coatings for touch-up work and as specified in paragraph FIELD APPLIED PAINTING.

2.30 SOURCE QUALITY CONTROL

2.30.1 Transformer Factory Tests

Submittal shall include routine NEMA ST 20 transformer test results on each transformer and also contain the results of NEMA "design" and "prototype" tests that were made on transformers electrically and mechanically equal to those specified.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations, including weatherproof and hazardous locations and ducts, plenums and other air-handling spaces, shall conform to requirements of NFPA 70 and IEEE C2 and to requirements specified herein.

3.1.1 Underground Service

Underground service conductors and associated conduit shall be continuous from service entrance equipment to outdoor power system connection.

3.1.2 Hazardous Locations

Work in hazardous locations, as defined by NFPA 70, shall be performed in strict accordance with NFPA 70 for particular "Class," "Division," and "Group" of hazardous locations involved. Provide conduit and cable seals where required by NFPA 70. Conduit shall have tapered threads.

3.1.3 Service Entrance Identification

Service entrance disconnect devices, switches, and enclosures shall be labeled and identified as such.

3.1.3.1 Labels

Wherever work results in service entrance disconnect devices in more than one enclosure, as permitted by NFPA 70, each enclosure, new and existing, shall be labeled as one of several enclosures containing service entrance disconnect devices. Label, at minimum, shall indicate number of service disconnect devices housed by enclosure and shall indicate total number of enclosures that contain service disconnect devices. Provide laminated plastic labels conforming to paragraph FIELD FABRICATED NAMEPLATES. Use lettering of at least 0.25 inch in height, and engrave on black-on-white matte finish. Service entrance disconnect devices in more than one enclosure, shall be provided only as permitted by NFPA 70.

3.1.4 Wiring Methods

Provide insulated conductors installed in rigid steel conduit, IMC, rigid nonmetallic conduit, or EMT, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for

circuit(s) installed in conduit and raceways.[Shared neutral, or multi-wire branch circuits, are not permitted with arc-fault circuit interrupters.] Minimum conduit size shall be 1/2 inch in diameter for low voltage lighting and power circuits. Vertical distribution in multiple story buildings shall be made with metal conduit in fire-rated shafts. Metal conduit shall extend through shafts for minimum distance of 6 inches.

Conduit which penetrates fire-rated walls, fire-rated partitions, or fire-rated floors shall be firestopped in accordance with Section 07840, FIRESTOPPING.

3.1.4.1 Pull Wire

Install pull wires in empty conduits. Pull wire shall be plastic having minimum 200-pound force tensile strength. Leave minimum 36 inches of slack at each end of pull wire.

3.1.5 Conduit Installation

Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 6 inches away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project.

3.1.5.1 Restrictions Applicable to EMT

- a. Do not install underground.
- b. Do not encase in concrete, mortar, grout, or other cementitious materials.
- c. Do not use in areas subject to severe physical damage including but not limited to equipment rooms where moving or replacing equipment could physically damage the EMT.
- d. Do not use in hazardous areas.
- e. Do not use outdoors.
- f. Do not use in fire pump rooms.

3.1.5.2 Restrictions Applicable to Nonmetallic Conduit

- a. PVC Schedule 40 and PVC Schedule 80
 - (1) Do not use in areas where subject to severe physical damage, including but not limited to, mechanical equipment rooms, electrical equipment rooms, hospitals, power plants, missile magazines, and other such areas.
 - (2) Do not use in hazardous (classified) areas.
 - (3) Do not use in penetrating fire-rated walls or partitions, or

fire-rated floors.

(4) Do not use above grade, except where allowed in this section for rising through floor slab or indicated otherwise.

3.1.5.3 Restrictions Applicable to Flexible Conduit

Use only as specified in paragraph FLEXIBLE CONNECTIONS.

3.1.5.4 Service Entrance Conduit, Underground

PVC, Type-EPC 40, galvanized rigid steel or steel IMC. Underground portion shall be encased in minimum of 3 inches of concrete and shall be installed minimum 48 inches below slab or grade.

3.1.5.5 Underground Conduit Other Than Service Entrance

Plastic-coated rigid steel; plastic-coated steel IMC; PVC, Type EPC-40. Plastic coating shall extend minimum 6 inches above floor.

3.1.5.6 Conduit for Circuits Rated Greater Than 600 Volts

Rigid metal conduit or IMC only.

3.1.5.7 Conduit Installed Under Floor Slabs

Conduit run under floor slab shall be located a minimum of 12 inches below the vapor barrier. Seal around conduits at penetrations thru vapor barrier.

3.1.5.8 Conduit Through Floor Slabs

Where conduits rise through floor slabs, curved portion of bends shall not be visible above finished slab.

3.1.5.9 Conduit Installed in Concrete Floor Slabs

Not allowed.

3.1.5.10 Stub-Ups

Provide conduits stubbed up through concrete floor for connection to free-standing equipment with adjustable top or coupling threaded inside for plugs, set flush with finished floor. Extend conductors to equipment in rigid steel conduit, except that flexible metal conduit may be used 6 inches above floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

3.1.5.11 Conduit Support

Support conduit by pipe straps, wall brackets, hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld

conduits or pipe straps to steel structures. Load applied to fasteners shall not exceed one-fourth proof test load. Fasteners attached to concrete ceiling shall be vibration resistant and shock-resistant. Holes cut to depth of more than 1 1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete joints shall not cut main reinforcing bars. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Conduit and box systems shall be supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts. Installation shall be coordinated with above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations.[Support exposed risers in wire shafts of multistory buildings by U-clamp hangers at each floor level and at 10 foot maximum intervals.] Where conduit crosses building expansion joints, provide suitable[watertight] expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means. For conduits greater than 2 1/2 inches inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.5.12 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

3.1.5.13 Locknuts and Bushings

Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.

3.1.5.14 Flexible Connections

Provide flexible steel conduit between 3 and 6 feet in length for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for motors. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size shall be 1/2 inch diameter. Provide liquidtight flexible conduit in wet and damp locations for equipment subject to vibration, noise transmission, movement or motors. Provide separate ground conductor across flexible connections.

3.1.5.15 Telecommunications and Signal System Pathway

Install telecommunications pathway in accordance with EIA TIA/EIA-569-A.

a. Horizontal Pathway: Telecommunications pathways from the work area to the telecommunications room shall be installed and cabling length requirements in accordance with EIA TIA/EIA-568-B.1. Size conduits, wireways, and cable trays in accordance with EIA TIA/EIA-569-A and as indicated.

b. Backbone Pathway: Telecommunication pathways from the telecommunications entrance facility to telecommunications rooms, and, telecommunications equipment rooms (backbone cabling) shall be installed in accordance with EIA TIA/EIA-569-A. Size conduits, for telecommunications risers in accordance with EIA TIA/EIA-569-A and as indicated.

3.1.6 Cable Tray Installation

Install cable trays parallel with or at right angles to ceilings, walls, and structural members. Support as indicated. In addition, install and ground telecommunications cable tray in accordance with EIA TIA/EIA-569-A, and TIA J-STD-607-A. Edges, fittings, and hardware shall be finished free from burrs and sharp edges. Provide No. 2 AWG bare copper wire throughout cable tray system, and bond to each section. Conductors that run through smoke and fire partitions shall be installed in 4 inch rigid steel conduits with grounding bushing, extending 12 inches beyond each side of partitions.

Seal conduit on both ends to maintain smoke and fire ratings of partitions. Provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.7 Boxes, Outlets, and Supports

Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, and when specifically indicated. Boxes in other locations shall be sheet steel. Each box shall have volume required by NFPA 70 for number of conductors enclosed in box. Boxes for mounting lighting fixtures shall be minimum 4 inches square, or octagonal, except that smaller boxes may be installed as required by fixture configurations, as approved. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature; fixtures shall be readily removable for access to boxes unless ceiling access panels are provided. Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; support sheet metal boxes directly from

building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved-type fastener maximum 24 inches from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

3.1.7.1 Boxes

Boxes for use with raceway systems shall be minimum 1 1/2 inches deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets shall be minimum 4 inches square. Telecommunications outlets shall be a minimum of 4 inches square by 2 1/8 inches deep. Mount outlet boxes flush in finished walls.

3.1.7.2 Pull Boxes

Construct of at least minimum size required by NFPA 70 of code-gauge galvanized sheet steel, except where cast-metal boxes are required in locations specified herein. Provide boxes with screw-fastened covers. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

3.1.7.3 Extension Rings

Extension rings are not permitted for new construction.

3.1.8 Mounting Heights

Mount panelboards, enclosed circuit breakers, motor controller and disconnecting switches so height of operating handle at its highest position is maximum 78 inches above floor. Mount lighting switches 48 inches above finished floor. Mount receptacles and telecommunications outlets 18 inches above finished floor, unless otherwise indicated. Wall-mounted telecommunications outlets shall be mounted at height 60 inches above finished floor. Mount other devices as indicated. Measure mounting heights of wiring devices and outlets in non-hazardous areas to center of device or outlet. Measure mounting heights of receptacle outlet boxes in hazardous areas 18 inches to the bottom of the outlet box.

3.1.9 Nonmetallic Sheathed Cable Installation

Where possible, install cables concealed behind ceiling or wall finish. Thread cables through holes bored on approximate centerline of wood members; notching of end surfaces is not permitted. Provide sleeves through concrete or masonry for threading cables. Install exposed cables parallel to or at right angles to walls or structural members. Protect exposed nonmetallic sheathed cables less than 4 feet above floors from mechanical injury by installation in conduit or tubing. When cable is used in metal stud construction, insert plastic stud grommets in studs at each point through which cable passes, prior to installation of cable.

3.1.10 Mineral Insulated, Metal Sheathed (Type MI) Cable Installation

Mineral-insulated, metal-sheathed cable system, Type MI, may be used in lieu of exposed conduit and wiring. Conductor sizes shall be not less than

those indicated for the conduit installation. Cables shall be fastened within 12 inches of each turn or offset and at 33 inches maximum intervals.

Make cable terminations in accordance with NFPA 70 and cable manufacturer's recommendations. Single-conductor cables of a circuit, having capacities of more than 50 amperes, shall terminate in a single box or cabinet opening. Individual conductors in all outlets and cabinets shall be color-coded.

3.1.11 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, color coding shall be by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, color coding shall be by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves. Identify control circuit terminations in accordance with manufacturer's recommendations. Provide telecommunications system conductor identification as specified in Section 16710, BUILDING TELECOMMUNICATIONS CABLING SYSTEMS.

3.1.11.1 Marking Strips

White or other light-colored plastic marking strips, fastened by screws to each terminal block, shall be provided for wire designations. The wire numbers shall be made with permanent ink. The marking strips shall be reversible to permit marking both sides, or two marking strips shall be furnished with each block. Marking strips shall accommodate the two sets of wire numbers. Each device to which a connection is made shall be assigned a device designation in accordance with NEMA ICS 1 and each device terminal to which a connection is made shall be marked with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, additional wire and cable designations for identification of remote (external) circuits shall be provided for the Government's wire designations. Prints of the marking strips drawings submitted for approval will be so marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.

3.1.12 Splices

Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

3.1.13 Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of 1/16 inch. Use of

sectional-type device plates are not permitted. Provide gasket for plates installed in wet locations.

3.1.14 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings in accordance with Section 07840, FIRESTOPPING.

3.1.15 Grounding and Bonding

Provide In accordance with NFPA 70. Ground exposed, non-current-carrying metallic parts of electrical equipment, access flooring support system, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, telecommunications system grounds, and neutral conductor of wiring systems. Make ground connection at main service equipment, and extend grounding conductor to point of entrance of metallic water service. Make connection to water pipe by suitable ground clamp or lug connection to plugged tee. If flanged pipes are encountered, make connection with lug bolted to street side of flanged connection. Supplement metallic water service grounding system with additional made electrode in compliance with NFPA 70. Make ground connection to driven ground rods on exterior of building. Interconnect all grounding media in or on the structure to provide a common ground potential. This shall include electrical service, telecommunications system grounds, as well as underground metallic piping systems. In addition to the requirements specified herein, provide telecommunications grounding in accordance with TIA J-STD-607-A. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

3.1.16 Equipment Connections

Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications but shall be provided under the section specifying the associated equipment.

3.1.17 Government-Furnished Equipment

Contractor shall rough-in for Government-furnished equipment to make equipment operate as intended, including providing miscellaneous items such as plugs, receptacles, wire, cable, conduit, flexible conduit, and outlet boxes or fittings.

3.1.18 Workmanship

Lay out work in advance. Exercise care where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary for proper installation, support, or anchorage of conduit, raceways, or other electrical work. Repair damage to buildings, piping, and equipment using skilled craftsmen of trades involved.

[3.1.19 Watthour Meters

NEMA C12.1.

3.1.20 Surge Protective Devices

Connect the surge protective devices in parallel to the power source, keeping the conductors as short and straight as practically possible.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side. Space the signs in accordance with NFPA 70E.

3.4 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09900, PAINTS AND COATINGS.][Where field painting of enclosures for panelboards, load centers or the like is specified to match adjacent surfaces, to correct damage to the manufacturer's factory applied coatings, or to meet the indicated or specified safety criteria, provide manufacturer's recommended coatings and apply in accordance to manufacturer's instructions.

3.5 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to each test.

3.5.1 Devices Subject to Manual Operation

Each device subject to manual operation shall be operated at least five times, demonstrating satisfactory operation each time.

3.5.2 600-Volt Wiring Test

Test wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance shall be 250,000 ohms.

3.5.3 Transformer Tests

Perform the standard, not optional, tests in accordance with the Inspection and Test Procedures for transformers, dry type, air-cooled, 600 volt and below; as specified in NETA ATS. Measure primary and secondary voltages

for proper tap settings. Tests need not be performed by a recognized independent testing firm or independent electrical consulting firm.

3.5.4 Ground-Fault Receptacle Test

Test ground-fault receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed.

3.5.5 Grounding System Test

Test grounding system to ensure continuity, and that resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to Contracting Officer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

3.5.6 Watthour Meter

a. Visual and mechanical inspection

(1) Examine for broken parts, shipping damage, and tightness of connections.

(2) Verify that meter type, scales, and connections are in accordance with approved shop drawings.

b. Electrical tests

(1) Determine accuracy of meter.

(2) Calibrate watthour meters to one-half percent.

(3) Verify that correct multiplier has been placed on face of meter, where applicable.

-- End of Section --

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SECTION 16446

PANELBOARDS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2003) Enclosures for Electric Equipment
(1000 Volts Maximum)

NEMA AB 1 (1999) Molded Case Circuit Breakers and
Molded Case Switches

NEMA PB 1 (2000) Panelboards

UNDERWRITERS LABORATORIES (UL)

UL 67 (2003) Panelboards

1.2 GENERAL REQUIREMENTS

Section 16003 GENERAL ELECTRICAL PROVISIONS applies to work specified in this section.

Detail Drawings shall be submitted for the panelboards consisting of fabrication and assembly drawings for all parts of the work in sufficient detail to enable the Government to check conformity with the requirements of the contract documents. Drawings shall include details of bus layout.

Outline Drawings for panelboards shall indicate overall physical features, dimensions, ratings, service requirements, and weights of equipment.

Statements signed by responsible officials of a manufacturer of a product, system, or material attesting that the product, system or material meet specified requirements. Statements must be dated after the award of this contract, name the project, and list the specific requirements which it is intended to address.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Detail Drawings and Outline Drawings shall be submitted for panelboards in accordance with paragraph entitled, "General Requirements," of this section.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Panelboards
Directory Card and Holder

SD-04 Samples

Keys shall then be properly tagged and delivered to the Contracting Officer.

SD-06 Test Reports

Test reports shall be submitted for the following tests in accordance with the paragraph entitled, "Site Testing," of this section. Panelboards shall not be energized until the recorded test data have been submitted to and approved by the Contracting Officer.

Continuity Tests
Insulation Tests

SD-07 Certificates

Statements shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

SD-08 Manufacturer's Instructions

Manufacturer's instructions shall be submitted for Panelboards including special provisions required to install equipment components and system packages. Special notices shall detail impedances, hazards and safety precautions.

PART 2 PRODUCTS

2.1 PANELBOARDS

Power-distribution panelboards and lighting and appliance branch-circuit panelboards shall be totally enclosed in a steel cabinet, dead-front circuit breaker type with copper buses, surface- or flush-mounted as indicated. Panelboards shall conform to NEMA PB 1 and NEMA AB 1. Branch circuit panels shall have buses fabricated for bolt-on type circuit breakers.

An outer door or cover, hinged on one side, shall be provided on panelboards to provide gutter space access. A center door shall be provided for circuit breaker/switch access only.

Voltage and current rating, number of phases, and number of wires shall be as indicated. Four-wire distribution panelboards and lighting and appliance branch-circuit panelboards shall be provided with an isolated full-capacity neutral bus. Panelboards shall be rated for 120/208-volt, three-phase, 60-hertz current.

Three-phase, 4-wire and single-phase, 3-wire distribution lighting and branch circuit panelboards shall be provided with an isolated full-capacity bus providing spaces for single-pole circuit breakers/switches and spaces indicated as spare.

Panelboards shall be provided with a separate grounding bus bonded to the enclosure. Grounding bus shall be a solid bus bar of rectangular cross section equipped with binding screws for the connection of equipment grounding conductors.

Each panelboard, as a complete unit, shall have a short-circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or as indicated.

Panelboards and main lugs or main breaker shall have current ratings as shown on the panelboard schedule.

Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type. Three-phase, four-wire busing shall be such that when any three adjacent single-pole breakers are individually connected to each of the three different phases, two- or three-pole breakers can be installed at any location. Current-carrying parts of the bus assembly shall be plated. Mains ratings shall be as shown.

Mechanical lugs furnished with panelboards shall be cast copper or copper alloys of sizes suitable for the conductors indicated to be connected thereto.

Boxes shall have the manufacturer's standard knockouts and shall be galvanized code-gage sheet steel. Fronts shall be of code-gage sheet steel furnished with hinged doors with adjustable trim clamps for securing the fronts to the boxes.

Panelboard box shall be galvanized code-gage sheet steel without knockouts.

Entire panelboard front shall be hinged on one side with a piano hinge for the full height and shall also have captive screws opposite the hinged side. Where panelboards are installed flush with the walls, the installation details shall be such that the hinged front can be opened without damage to the adjacent wall surfaces. Color of the finished coat of trim and front shall match the adjacent walls except that when the box is installed in electrical closets or equipment rooms, the gray finish as specified will be acceptable.

Panelboard enclosures shall be NEMA 250, Type 1. Enclosures shall be provided with corrosion-resistant steel pin-tumbler cylinder locks. Locks shall be keyed alike, and two keys shall be provided for each enclosure.

Panelboards shall be finished with baked enamel.

2.2 CIRCUIT BREAKERS

Circuit breakers shall be the molded-case type as specified in Section 16286 OVERCURRENT PROTECTIVE DEVICES. Frame and trip ratings shall be as indicated.

Interrupting rating of circuit breakers shall be as indicated. If not shown, the interrupting rating for circuit breakers in 120/208-volt panelboards shall be not less than 10,000 amperes rms symmetrical, and that for breakers in 277/480-volt panelboards shall be not less than 25,000 amperes rms symmetrical.

Circuit breakers shall be bolt-on type. Plug-in type shall not be acceptable.

Shunt trips shall be provided where indicated.

In branch circuit panelboards, branch circuit breakers feeding convenience outlets shall have sensitive instantaneous trip settings of not more than 10 times the trip rating of the breaker to prevent repeated arcing shorts resulting from frayed appliance cords. Single-pole 15- and 20-ampere circuit breakers shall be UL listed as "Switching Breakers" at 120 volts ac. UL Class A (5-milliampere sensitivity) ground fault circuit protection shall be provided on 120-volt ac branch circuit as indicated. This protection shall be an integral part of the branch circuit breaker that also provides overload and short-circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single-pole circuit breaker with integral ground fault circuit interruption shall require no more panelboard branch circuit space than a conventional slide pole circuit breaker.

Connections to the bus shall be bolt-on type.

When multiple wires per phase are specified, the circuit breakers shall be furnished with connectors made to accommodate multiple wires.

Circuit breaker spaces called out on the drawings shall be complete with mounting hardware to permit ready installation of the circuit breakers.

2.3 DIRECTORY CARD AND HOLDER

A directory card shall be mounted on the inside of hinged fronts and doors under glass 0.030-inch thick minimum plastic in a metal frame, with spaces for circuit numbers, outlets controlled, and room numbers. Where hinged fronts or doors are not required, the directory card shall be provided 0.030-inch thick minimum plastic in a metal frame mounted on the left-hand side of the front trim. Directory card shall identify each branch circuit with its respective and numbered circuit breaker.

2.4 FACTORY TESTING

Complete panelboards shall be tested in accordance with UL 67.

2.5 PRECAUTIONARY LABEL

To ensure persons are aware of immediate or potential hazard in the application, installation, use, or maintenance of panelboards, each panelboard shall be conspicuously marked on the trim or dead front shield with the text (or equivalent) **DANGER** symbol. If the panel is supplied with a door, the label shall be visible when the door is in the open position.

PART 3 EXECUTION

3.1 INSTALLATION

Panelboards shall be installed as indicated and in accordance with the manufacturer's instructions. Panels shall be fully aligned and mounted so that the height of the top operating handle will not exceed 72-inches above the finished floor.

Directory-card information shall be typewritten in capital letters to indicate devices controlled and final room numbers served by each circuit and shall be mounted in holders behind protective covering.

3.2 SITE TESTING

Each panelboard enclosure key shall be shown to operate the enclosure locks in the presence of the Contracting Officer.

Panelboards shall be given continuity and insulation tests after the installation has been completed and before the panelboard is energized.

Test equipment, labor, and personnel shall be provided by the Contractor as required to perform the tests as specified. Continuity tests shall be conducted using a dc device with bell.

Insulation tests on 480-volt panelboards shall be conducted using a 1,000-volt insulation-resistance test set. Readings shall be recorded every minute until three equal and consecutive readings have been obtained. Resistance between phase conductors and between phase conductors and ground shall be not less than 50 megohms.

Insulation tests on panelboards rated 300 volts or less shall be conducted using a 500-volt minimum insulation-resistance test set. Readings shall be recorded after 1 minute and until the reading is constant for 15 seconds. Resistance between phase conductors and between phase conductors and ground shall be not less than 25 megohms.

Test data shall be recorded and shall include the location and identification of panelboards and megohm readings versus time.

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SECTION 16495

MEDIUM VOLTAGE FUSES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C37.42 (1997) Specifications for High Voltage
Expulsion Type Distribution Class Fuses,
Cutouts, Fuse Disconnecting Switches and
Fuse Links

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA SG 2 (1993) High-Voltage Fuses

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-03 Product Data

Equipment and Performance Data shall be submitted for distribution fuse cutouts in accordance with paragraph entitled, "General Requirements," of this section.

Manufacturer's catalog data shall be submitted for the following items:

Distribution Fuse Cutouts

SD-02 Shop Drawings

Fabrication Drawings shall be submitted for fuse cutouts in accordance with paragraph entitled, "General Requirements," of this section.

Installation drawings shall be submitted for Distribution Fuse Cutouts in accordance with the paragraph entitled, "Installation," of this section.

SD-08 Manufacturer's Instructions

Manufacturer's instructions shall be submitted for Fuse Cutouts

including special provisions required to install equipment components and system packages. Special notices shall detail impedances, hazards and safety precautions.

1.3 GENERAL REQUIREMENTS

Section 16003 GENERAL ELECTRICAL PROVISIONS applies to work specified in this section.

Fabrication Drawings shall be submitted for fuse cutouts consisting of fabrication and assembly details to be performed in the factory.

Equipment and Performance Data shall be submitted for distribution fuse cutouts including life, test, system functional flows, safety features, and mechanical automated details.

PART 2 PRODUCTS

2.1 EQUIPMENT STANDARDS

Distribution fuse cutouts shall conform to the requirements of NEMA SG 2 and ANSI C37.42 and as specified.

2.2 FUSE CUTOUTS

Distribution fuse cutouts for application on distribution systems shall be the self-contained, enclosed, dropout type, or open type when required for higher voltage or interrupting rating. Loadbreak cutouts shall be installed only if specifically indicated.

The interrupting capacity shall be sufficient to break the maximum system fault current to which the cutout will be subjected. The minimum interrupting capacity shall be 16,000 amperes root mean square asymmetric.

Cutouts shall be either heavy-duty or extra-heavy-duty classification. Cutouts installed on three-phase, 13.2-kilovolt (kV) or 13.8-kV systems shall be rated at 15 kV. The installation of cutouts rated at 7.8 kV on these systems will not be allowed.

Fuse links shall have a continuous rating equal to approximately 150 percent of the full-load line current when used for transformer protection, and approximately 100 percent of the conductor rated capacity when used for circuit protection. The 15-kV cutout shall have a wet withstand, 10-second voltage rating of 37 kV, with a 95-kV basic impulse level (BIL). The continuous current rating shall be 100 amperes unless otherwise indicated. Fuse disconnects shall be rated not less than 100 amperes and shall have attachments to permit manual operation of the disconnect under load without external arcing.

Where indicated, lightning arresters and fuse cutouts shall be combined.

PART 3 EXECUTION

3.1 INSTALLATION

Distribution fuse cutouts shall be installed in accordance with the manufacturer's installation instructions.

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SECTION 16511

FLUORESCENT LUMINAIRES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI C78.1 (1991; R 1996) 18W, 24W, and 36W Single Ended Fluorescent Lamps
- ANSI C78.3 (1991; C78.3d-1998; R 1996) Fluorescent Lamps - Instant-Start and Cold-Cathode Types - Dimensional and Electrical Characteristics
- ANSI C82.2 (2002) Fluorescent Lamp Ballasts - Methods of Measurement

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

- NEMA C82.1 (1997; R 1992) Ballasts for Fluorescent Lamps

U.S. DEPARTMENT OF ENERGY (DOE)

- DOE LT-1 (2000) How to Buy Energy-Efficient Fluorescent Tube Lamps
- DOE LT-2 (2000) How to Buy Energy-Efficient Fluorescent Ballasts
- DOE LT-3 (2000) How to Buy Energy-Efficient Fluorescent Luminaires
- DOE LT-5 (2000) How to Buy Energy-Efficient Compact Fluorescent Light Bulbs

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

- FCC Part 18 RF Lighting Devices

UNDERWRITERS LABORATORIES (UL)

- UL 844 (1999; Rev thru Mar 1999) UL Standard for Safety Electric Lighting Fixtures for Use in Hazardous (Classified) Locations

UL 935 (2001; 10th Ed) UL Standard for Safety
Fluorescent-Lamp Ballasts

1.2 GENERAL REQUIREMENTS

Section 16003 GENERAL ELECTRICAL PROVISIONS applies to work specified in this section.

Outline Drawings shall be submitted for the fluorescent fixtures indicating overall physical features, dimensions, ratings, service requirements, and weights of equipment.

Manufacturer's catalog data shall be submitted for all fluorescent lighting fixtures, ballasts and lamps.

Test Reports shall show compliance with the requirements of this specification as follows:

Lighting-Distribution Curves for each type of fixture shall be prepared utilizing the fixture manufacturer's own facilities or those of an independent nationally recognized laboratory, in accordance with the standard procedure developed by the Illuminating Engineering Society.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Fabrication drawings shall be submitted for the following items:

Fluorescent Lighting Fixtures
Fluorescent Lamp Ballast
Fluorescent Lamps

Outline Drawings shall be submitted for fluorescent fixtures in accordance with paragraph entitled, "General Requirements," of this section.

SD-03 Product Data

Equipment and performance data shall be submitted for the following including life, test, system functional flows, safety features, and mechanical automated details.

Fluorescent Lighting Fixtures
Fluorescent Lamp Ballast
Fluorescent Lamps

Manufacturer's catalog data shall be submitted for the following items:

Compact Fluorescent Fixtures

SD-06 Test Reports

Test Reports shall be submitted for the following in accordance with paragraph entitled, "General Requirements," of this section.

Lighting-Distribution Curves

SD-07 Certificates

Certificates shall be submitted for the following showing conformance with the referenced standards contained in this section.

Fluorescent Lighting Fixtures
Fluorescent Lamp Ballast
Fluorescent Lamps
Compact Fluorescent Fixtures
Efficiencies

1.4 ELECTRONIC BALLAST WARRANTY

Furnish the electronic ballast manufacturer's warranty. The warranty period shall not be less than 5 years from the date of manufacture of the electronic ballast. Ballast assembly in the lighting fixture, transportation, and on-site storage shall not exceed 12 months, thereby permitting 4 years of the ballast 5 year warranty to be in service and energized. The warranty shall state that the malfunctioning ballast shall be exchanged by the manufacturer and promptly shipped to the using Government facility. The replacement ballast shall be identical to, or an improvement upon, the original design of the malfunctioning ballast.

PART 2 PRODUCTS

2.1 PRODUCT STANDARDS

Fixtures in hazardous areas shall conform to UL 844.

Fluorescent lighting fixtures shall be furnished completely assembled with wiring and mounting devices and ready for installation at the locations indicated. Recessed fixtures in suspended ceilings shall be designed and equipped for installation in the type of ceiling in which the fixture is to be installed. Fixtures shall be designed to be supported independent of the ceiling and shall be equipped with the lamps indicated.

Lighting fixtures shall have efficiencies in accordance with the recommended levels specified in DOE LT-3.

2.2 COMMERCIAL FIXTURES

Lighting fixtures shall include wiring channel, end plates, end caps, side panels, top reflectors, bottom closures, lampholders, lamps, ballasts,

suspension stems, wiring, and other necessary materials and devices.

Ballasts and wiring shall be completely enclosed in the wiring channel and shall be easily accessible. Ballast shall be replaceable without removing the fixture from its mounting. Lamps shall be replaceable without the use of tools and without removal of other lamps and equipment.

Wiring channel, end plates, and other sheet steel enclosure components shall be cold-rolled carbon-steel sheet of commercial quality not less than 20 gage.

When two or more fixtures are joined together in continuous rows, the wiring channel shall form an open and continuous wireway.

2.2.1 Surface-Mounted Fixtures

Surface-mounted fixtures shall be designed to be fastened to wall or ceiling flush-mounted outlet boxes. When two or more fixtures are joined together in continuous rows, the wiring channel shall form an open and continuous wireway.

2.2.2 Recessed Fixtures

Recessed fixtures in suspended ceilings shall be equipped with frames, yokes, and adjustable mounting brackets designed for the type of ceiling construction in which the fixture is to be installed. Bottom closure shall be hinge framed with nickel-plated latching devices.

2.2.3 Pendant-Mounted Fixtures

Pendant-mounted fixtures shall be equipped with stems, swivel, ball-and-socket self-aligning hangers, ceiling canopies, and fixture-leveling devices. Stems shall be not less than 1/2 inch in diameter, made from seamless steel tubing. Stem length, material, and finish shall be as indicated.

2.2.4 Compact Fluorescent Fixtures

Compact fluorescent fixtures shall be manufactured specifically for compact fluorescent lamps with ballasts integral to the fixture. Providing assemblies designed to retrofit incandescent fixtures is prohibited except when specifically indicated for renovation of existing fixtures.

2.3 INDUSTRIAL FIXTURES

Lower edge of the reflector shall be formed into a flange or bead to provide stiffness and shall be completely covered by the finish. Each reflector shall be removable and securely maintained in position with latch fastening devices. Reflector shall form the bottom of the wiring-channel enclosure.

Direct-lighting fixture reflectors shall be so shaped that the ratio of the candlepower at 55 degrees nadir to the candlepower at nadir shall be not less than 55 percent. Upward component of light shall be a minimum of 8

percent and a maximum of 20 percent of the total light output.

Pendant-mounted fixtures shall be equipped with straps, brackets, conduit stems, ball-and-socket self-aligning hangers, ceiling canopies, slide-clamp fixture hangers, and leveling devices. Stems shall be not less than 1/2 inch in diameter, seamless brass, steel, or aluminum tubing. Stem length and finish shall be as indicated. When two or more fixtures are joined together, the wiring channel shall form an open and continuous wireway.

Chain-supported fixtures shall be equipped with straps, brackets, ceiling-mounted chain hangers, chain, hooks, and slide-clamp fixture hangers.

Compact fluorescent fixtures shall be manufactured specifically for compact fluorescent lamps with ballasts integral to the fixture. Providing assemblies designed to retrofit incandescent fixtures is prohibited except when specifically indicated for renovation of existing fixtures.

2.4 FLUORESCENT LAMP BALLAST

Fluorescent lamp ballasts shall be Class P in accordance with NEMA C82.1, ANSI C82.2, and UL 935.

Ballasts shall have efficiencies in accordance with the recommended levels specified in DOE LT-2.

Ballasts shall be designed for single- or two-lamp operation with line power factor not less than 90 percent. Two-lamp ballasts shall operate the two lamps out of phase with each other. Lamp cathodes shall be continuously heated during lamp operation.

Fluorescent lighting fixtures with lamps 30 watts or more shall be equipped with rapid-start ballasts. All fluorescent lighting fixtures with lamps rated 20 watts or less shall be equipped with rapid-start ballasts. Auxiliary lamp starters shall not be permitted.

Ballasts shall be voltage rated for operation on 120-volt, single-phase, 60-hertz lighting distribution systems as indicated.

Ballasts shall be designed for a maximum ambient temperature of 105 degrees F.

Ballasts for outdoor lamps shall have a minimum starting temperature of minus 20 degrees F.

2.4.1 Electronic Ballasts

Ballasts shall not contain polychlorinated biphenyls (PCB's).

Ballasts shall operate with a 90 to 110 percent input voltage variation at an input frequency of 60 Hz. Light output shall remain constant for line voltage fluctuations of plus or minus 3 percent. Ballasts shall be rapid start type.

Ballasts shall have a minimum power factor of 0.95.

Ballasts shall comply with Class A (20-24 DB) sound rating.

Ballasts shall comply with Electromagnetic Interference (EMI) and Radio Interference (RFI) limits set by the FCC Part 18, CFR, Chapter 18, Part C.

Ballasts shall have less than 10 percent Total Harmonic Distortion.

Ballasts shall have a full replacement warranty of 5 years from date of manufacture as specified in paragraph entitled "Electronic Ballast Warranty" herein.

Ballast size and mounting configuration shall be consistent with standard electromagnetic ballast for same application.

Single or three lamp ballast shall be tandem wired, if they are in the same room and within the following distances: recess mounted - 10 feet center to center pendant or surface mounted 1 foot separation.

2.4.2 Rapid Start Ballasts

Ballast factor shall be between 0.85 and 1.0 when tested with a full-wattage [T-8][T-5] lamp.

Ballasts shall be capable of operating remaining lamps if one or more companion lamps fail or are removed.

2.4.3 Compact Fluorescent Ballasts

Ballast factor shall be no less than 0.85 when tested with a compatible lamp.

Ballasts and related hardware for indoor use shall start lamps at a starting temperature of 50 degrees F.

2.5 FLUORESCENT LAMPS

Lamps shall conform to ANSI C78.1 ANSI C78.3 and shall be the energy-efficient type with a minimum starting temperature of 60 degrees F.

2.5.1 Rapid Start Lamp

Lamps shall have efficiencies in accordance with the recommended levels specified in DOE LT-1

Rapid start lamps shall have bulb designation T-8 a base configuration of medium bipin contact.

Lamps shall have an average rated life at 3 hours per start of 20,000 hours.

Lamp lumen depreciation shall result in a mean lumen value of at least 90 percent of the final lamp lumens at 8,000 operating hours and at least 84 percent of the initial lamp lumens at 14,000 operating hours.

Bulb color shall be 3500K with a minimum color rendering index of 70. Lamp dimensions shall be in accordance with ANSI C78.1.

2.5.2 Instant Start Lamp

Lamps shall have efficiencies in accordance with the recommended levels specified in DOE LT-1

Rated lamp life shall be at least 15,000 hours.

Lamp lumen depreciation shall result in a mean lumen value of at least 90 percent of the final lamp lumens at 6,000 operating hours and at least 84 percent of the initial lamp lumens at 10,500 operating hours.

Bulb color shall be 3500K with a minimum color rendering index of 78. Lamp dimensions shall be in accordance with ANSI C78.1.

2.5.3 Compact Fluorescent Lamp

Lamps shall have efficiencies in accordance with the levels specified in DOE LT-5.

Lamps shall utilize phosphors of a composition which includes rare earth phosphors with a color temperature of 3500 K and a minimum color rendering index of 80.

Lamp lumen depreciation shall result in a mean lumen value of at least 85 percent of initial lamp lumens at 40 percent of rated life.

PART 3 EXECUTION

3.1 INSTALLATION

A fixture shall be installed at each outlet indicated, and lamps of the proper type and wattage shall be installed in each fixture.

Immediately prior to occupancy, clean reflector cones, reflectors, aperture plates, lenses, louvers, and decorative elements. To prevent static buildup on lenses and reflectors, clean with a manufacturer's recommended water-diluted solution of glass cleaner and allow to air-dry after installation.

Replace any broken or defective parts prior to final inspection.

Fixtures shall be installed parallel and perpendicular to major axes of structures and shall be plumb and aligned to a tolerance of 1/2 inch in 10 feet.

Supports for recessed fixtures shall have a minimum capacity of 150 pounds, and all parts of the support shall be arranged to prevent them from vibrating free.

Supports for recessed fixtures in suspended ceilings shall be so arranged

that each corner of each fixture is supported by a hanger wire anchored to a structural member or to the structure to afford adequate seismic anchorage.

Surface-mounted fixtures shall be attached securely to structural members or to metal supports that span structural members. Fixtures shall be fastened near each end and, when over 4-feet long, shall also be fastened at the center. When surface-mounted fixtures are not UL approved for direct mounting on combustible ceilings, suitable spacers shall be installed.

Fixtures located in equipment rooms shall be so installed that they clear all obstructions such as duct, piping, bracing, and supports.

3.2 FIELD TESTING

Fluorescent lighting fixtures shall be demonstrated to operate satisfactorily in the presence of the Contracting Officer.

-- End of Section --

SECTION 16512

HIGH INTENSITY DISCHARGE (HID) LUMINAIRES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C82.5 (1990; R 1995) Reference Ballasts -
High-Intensity-Discharge and Low Pressure
Sodium Lamps

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

NEMA C82.4 (2002) For Lamp Ballasts - Ballasts for
High-Intensity-Discharge and Low Pressure
Sodium Lamps (Multiple-Supply Type)

NEMA C82.9 (1996; C82.9b) High-Intensity-Discharge
and Low-Pressure Sodium Lamps, Ballasts,
and Transformers - Definitions

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

U.S. DEPARTMENT OF ENERGY (DOE)

DOE LT-6 (2000) How to Buy Energy-Efficient
Industrial HID Luminaires

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

21 CFR 1040 (1995) Performance Standards for
Light-Emitting Products

UNDERWRITERS LABORATORIES (UL)

UL 844 (1999; Rev thru Mar 1999) UL Standard for
Safety Electric Lighting Fixtures for Use
in Hazardous (Classified) Locations

1.2 GENERAL REQUIREMENTS

Section 16003 GENERAL ELECTRICAL PROVISIONS applies to work specified in this section.

Material, Equipment, and Fixture Lists shall be submitted for HID lighting fixtures including manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site information.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists shall be submitted for HID lighting fixtures in accordance with paragraph entitled, "General Requirements," of this section.

SD-02 Shop Drawings

Installation Drawings shall be submitted for the high intensity lighting fixtures in accordance with the paragraph entitled, "Installation," of this section.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

- Commercial Lighting Fixtures
- Industrial Lighting Fixtures
- Lamp Ballasts
- Lamps

SD-06 Test Reports

Test reports shall be submitted for Operational Tests on HID lighting fixtures in accordance with the paragraph entitled, "Field Testing," of this section.

SD-07 Certificates

Certificates shall be submitted showing compliance with the following requirements:

- Efficiencies

PART 2 PRODUCTS

2.1 PRODUCT STANDARDS

Fixtures in hazardous areas shall conform to UL 844.

Lighting fixtures shall be furnished completely assembled with wiring and mounting devices and ready for installation at the locations indicated.

Recessed fixtures in suspended ceilings shall be designed and equipped for installation in the type of ceiling in which the fixture is to be installed. Fixtures shall be designed to be supported independent of the ceiling. Fixtures shall be equipped with the lamps indicated.

2.1.1 Efficiencies

Lighting fixtures shall have efficiencies in accordance with the recommended levels specified in DOE LT-6.

2.2 COMMERCIAL LIGHTING FIXTURES

Commercial HID lighting fixtures shall be of the types and designs indicated, completely assembled, wired, and ready for connection to the building lighting-distribution system.

2.3 INDUSTRIAL LIGHTING FIXTURES

Fixture assembly shall include a nondetachable reflector, gaskets, porcelain lampholder, and cast-aluminum flange and capnut, with a threaded pipe fitting suitable for stem mounting. Reflector shall be seamless porcelain-enameled steel with beaded bottom edge completely covered by the finish. Porcelain lampholder shall be attached to the flange with mounting screws. Reflector shall be rigidly supported between the threaded lower flange and threaded capnut with gaskets to protect the reflector finish. A threaded, molded, porcelain-lampholder cover shall provide access to the lampholder wiring terminals. Lampholder screw shells shall be designed for the mogul-base lamp indicated.

2.4 LAMP BALLASTS

2.4.1 Multiple-Circuit Ballasts

Multiple-circuit ballast shall include a two-winding core-and-coil assembly with a saturated-iron regulating element and capacitors impregnated with an insulating material in accordance with NEMA C82.4, ANSI C82.5, and NEMA C82.9.

Ballast shall maintain correct lamp operation over a voltage-input range of plus or minus 13 percent of rated voltage. Capacitors shall provide a power-factor lamp load not less than 95 percent.

Ballasts shall be voltage rated for operation on 120-volt, single-phase, 60-hertz lighting-distribution systems, as indicated.

Ballasts shall be designed for a minimum lamp starting temperature of minus 20 degrees F and a maximum ambient temperature of 105 degrees F.

Solid state ballasts shall be used when indicated.

2.4.2 Series Circuit Transformers

Series circuit transformers shall include a two-winding core-and-coil assembly designed for connection to constant-current supply circuits in

accordance with ANSI C82.5 and NEMA C82.9.

Primary winding of the transformer shall be designed for connection to 20-ampere constant-current street-lighting circuits. Transformer shall provide the proper starting voltage and operating current for the lamp indicated.

Transformers shall be designed for a maximum ambient temperature of 105 degrees F.

2.5 LAMPS

Lamps shall be certified to be automatically self-extinguishing and in conformance with 21 CFR 1040, Section 30, when HID lamps are used in a populated area.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be performed in accordance with NFPA 70.

HID fixtures shall be installed at each outlet indicated, and lamps of the proper type, voltage, and wattage shall be installed in each fixture.

New lamps shall be installed immediately prior to completion of the project. Lamps shall be installed with the light center at the focal point of the reflector and in the proper burning position.

High-bay fixtures shall be so installed that they clear obstructions such as crane rails, piping, and bracing that could impede operation of lowering devices.

Installation Drawings shall be submitted for the high intensity lighting fixtures. Drawings shall indicate overall physical features, dimensions, ratings, service requirements, and weights of equipment.

3.2 FIELD TESTING

HID lighting fixtures and their accessories, including lowering devices, shall be demonstrated to operate satisfactorily in the presence of the Contracting Officer.

Operational tests shall be performed in accordance with referenced standards in this section.

-- End of Section --

SECTION 16524

ROADWAY LIGHTING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|---------------|--|
| ANSI C78.1350 | (1990) Electric Lamps - 400-Watt,
100-Volt, S51 Single Ended, High-Pressure
Sodium Lamps |
| ANSI C78.1352 | (1990) 1000-Watt S52 High-Pressure Sodium
Lamps |
| ANSI C78.1353 | (1990) 70-Watt S62 High-Pressure Sodium
Lamps |
| ANSI C78.1355 | (1989) 150-Watt 55-Volt S55 High-Pressure
Sodium Lamps |
| ANSI C82.5 | (1990; R 1995) Reference Ballasts -
High-Intensity-Discharge and Low Pressure
Sodium Lamps |

ASTM INTERNATIONAL (ASTM)

- | | |
|-----------------|---|
| ASTM A 36/A 36M | (2003a) Standard Specification for Carbon
Structural Steel |
|-----------------|---|

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

- | | |
|------------|-------------------------|
| IESNA RP-8 | (2000) Roadway Lighting |
|------------|-------------------------|

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

- | | |
|---------|---|
| ISO 263 | (1973) ISO Inch Screw Threads - General
Plan and Selection for Screws, Bolts and
Nuts - Diameter Range 0.06 to 6 inch |
|---------|---|

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

- | | |
|------------|---|
| NEMA C82.4 | (2002) For Lamp Ballasts - Ballasts for
High-Intensity-Discharge and Low Pressure
Sodium Lamps (Multiple-Supply Type) |
| NEMA C82.9 | (1996; C82.9b) High-Intensity-Discharge |

and Low-Pressure Sodium Lamps, Ballasts,
and Transformers - Definitions

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

21 CFR 1040

(1995) Performance Standards for
Light-Emitting Products

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists shall be submitted for highway and roadway lighting fixtures in accordance with paragraph entitled, "General Requirements," of this section.

SD-02 Shop Drawings

Fabrication drawings shall be submitted for the following items consisting of fabrication and assembly details to be performed in the factory.

Street-Lighting Fixtures
Lighting Standards
Street-Lighting Luminaires

Installation Drawings shall be submitted for the highway and roadway lighting systems in accordance with the paragraph entitled, "Installation," of this section.

SD-03 Product Data

Equipment and Performance Data shall be submitted for highway and roadway lighting systems in accordance with paragraph entitled, "General Requirements," of this section.

Equipment Foundation Data for highway and roadway lighting shall be in accordance with the paragraph entitled, "Foundations for Lighting Standards," of this section.

Manufacturer's catalog data shall be submitted for the following items:

Street-Lighting Fixtures
Lighting Standards
Street-Lighting Luminaires

SD-06 Test Reports

Test reports shall be submitted for Operational Tests on

incandescent lighting fixtures in accordance with the paragraph entitled, "Field Testing," of this section.

SD-07 Certificates

Certificates shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

1.3 GENERAL REQUIREMENTS

Section 16003 GENERAL ELECTRICAL PROVISIONS applies to work specified in this section.

Material, Equipment, and Fixture Lists shall be submitted for highway and roadway lighting fixtures including manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site information.

Equipment and Performance Data shall be submitted for highway and roadway lighting systems consisting of life test, system functional flows, safety features, mechanical automated details, automatic interlocks, and such features as electrical system protective device ratings.

Certificates shall be submitted showing compliance with the following requirements:

Lighting-distribution curves for each type of fixture shall be prepared utilizing the fixture manufacturer's own facilities or those of an independent nationally recognized laboratory, in accordance with the standard procedure developed by the Illuminating Engineering Society.

PART 2 PRODUCTS

2.1 STREET-LIGHTING FIXTURES

Street-lighting fixtures, including standards and luminaires, shall be furnished complete with wiring and mounting devices ready for installation at the locations indicated. Fixtures shall be equipped with lamps.

2.2 LIGHTING STANDARDS

Lighting standard, includes pole, anchor base, transformer base, brackets, and accessories. Lighting standards shall be designed to withstand vertical and horizontal loading on the entire structure and supported equipment without damage or permanent deformation to any component of the lighting standard.

2.2.1 Aluminum Lighting Standards

Aluminum poles shall be continuously tapered and shall have a brushed satin finish.

Brackets for street lighting luminaires shall be detachable with pole and bracket adapter fittings of cast-aluminum alloy. Adapter fittings shall be

welded to pole and bracket and bolted together with aluminum alloy or corrosion-resistant steel hexagon-head bolts. Tenon end of the bracket shall accommodate the luminaire indicated.

Anchor base shall be cast-aluminum alloy, seam welded to the pole at the upper outer edge of the flange and the lower edge of the pole. Anchor base shall have anchor-bolt holes for connection to anchor bolts or the top of transformer base.

Transformer base shall be a one-piece casting of cast-aluminum alloy, with a removable cast-aluminum flanged access cover held in place with bolts or screws. Transformer base shall have anchor-bolt holes in the base for connection to anchor bolts in the foundation and bolt holes in the top for connection to pole anchor base.

Standards without transformer bases shall be equipped with oval-shaped handhole with reinforced sheet aluminum frame and cover with center of opening 18-inches above the foundation.

Standards shall be furnished with a 1/2-inch square nut, 13 threads per inch, as specified in ISO 263, welded to the inside of the pole for ground connections.

Accessories shall be provided, including cast-aluminum ornamental pole-top cap, pole-top tenons, aluminum-alloy or corrosion-resistant steel nuts, bolts, and washers, and galvanized sheet metal leveling shims.

2.3 STREET-LIGHTING LUMINAIRES

Street-lighting luminaires shall be enclosed and gasketed vaportight fixtures in accordance with IESNA RP-8 for Types I, II, III, IV, and V lighting-distribution patterns.

2.3.1 End-Mounted High-Intensity-Discharge (HID) Luminaires

End-mounted HID luminaires with horizontal lamp-burning position shall include a hinged two- or three-piece housing, reflector, refractor, refractor holding ring, lampholder, fuses, fuseholders, terminal block, ballast, and lamp in a completely sealed optical system for end-mounting to street-lighting standards. Wiring shall be concealed in street-lighting standards and luminaires.

Upper housing shall be cast aluminum with fixture-leveling pad, integral slip fitter, pipe stop, and clamps with provision for vertical adjustments of plus or minus 3 degrees for leveling purposes.

Porcelain lampholder shall be mounted on an adjustable supporting bracket that will permit vertical and horizontal positioning of the lamp. Reflector shall be formed from anodized sheet aluminum and shall have a specular finish. Refractor shall be molded prismatic heat-resistant borosilicate glass designed to provide the lighting-distribution pattern indicated. Refractor cover shall allow for expansion and contraction of the refractor with ambient temperature changes from 0 to 105 degrees F.

Refractor holding ring and ballast cover shall be cast aluminum and shall form the lower housing. Lower housing shall be equipped with corrosion-resistant steel hinge and hinge pin, spring-loaded safety catch, and refractor latching mechanism. Upper housing shall overlap the lower housing with a heat-resistant gasket that will provide a seal against moisture, dirt, and insects.

2.3.2 Side-Mounted (HID) Luminaires

Side-mounted (HID) luminaires with base-up vertical lamp-burning position shall include a universal head with built-in ballast, lamp, porcelain lampholder, and reflector assembly in a completely sealed optical system for bracket mounting to street-lighting standards. Wiring shall be concealed in street-lighting standards and luminaires.

Universal head shall be cast aluminum with integral side-mounting slip fitter, pipe stop, and clamps with provisions for vertical adjustments of plus or minus 3 degrees for leveling purposes.

Reflector assembly shall include a reflector, refractor, and clamping band.

Reflector shall be formed from anodized sheet aluminum and shall have a specular finish. Refractor shall be molded prismatic heat-resistant borosilicate glass designed to provide the lighting-distribution pattern indicated. Clamping band shall be formed from sheet aluminum or corrosion-resistant steel and shall completely seal the joint between reflector and refractor against moisture, dirt, and insects.

Reflector assembly shall latch directly to the universal head with aluminum or corrosion-resistant steel latches. Latches and seating flange shall provide a seal against moisture, dirt, and insects.

2.3.3 Lamp Ballasts

2.3.3.1 Multiple-Circuit Ballasts

Multiple-circuit ballasts shall include a two-winding core-and-coil assembly with a saturated-iron regulating element and capacitors impregnated with an insulating material in accordance with NEMA C82.4, ANSI C82.5, and NEMA C82.9.

Ballasts shall maintain correct lamp operation over a voltage-input range of plus or minus 13 percent of rated voltage. Capacitors shall provide a power factor lamp load of not less than 95 percent.

Ballasts shall be voltage rated for operation on 120-volt, single-phase, 60-hertz lighting-distribution systems as indicated.

Ballasts shall be designed for a minimum lamp starting temperature of minus 20 degrees F and a maximum ambient temperature of 105 degrees F.

2.3.3.2 Series Circuit Transformers

Series transformers shall include a two-winding core-and-coil assembly designed for connection to constant-current supply circuits in accordance

with ANSI C82.5 and NEMA C82.9.

Primary winding of the transformer shall be designed for connection to 6.6-or 20-ampere constant-current street-lighting circuits. Transformer shall provide the proper starting voltage and operating current for the lamp indicated.

Transformers shall be designed for a maximum ambient temperature of 105 degrees F.

2.3.4 Lamps

Lamps, if used in a populated area, shall be certified to be automatically self-extinguishing and shall conform to 21 CFR 1040, Section 30.

2.3.4.1 (HID) Lamps and Ballasts

(HID) lamps and ballasts shall be compatible and shall be furnished as specified on drawings. High pressure sodium lamps shall comply with the following industry standards:

1,000 watts	ANSI C78.1352
400 watts	ANSI C78.1350
150 watts	ANSI C78.1355
70 watts	ANSI C78.1353

PART 3 EXECUTION

3.1 FOUNDATIONS FOR LIGHTING STANDARDS

Foundations for lighting standards shall be in accordance with manufacturer's recommendations at a minimum unless noted otherwise.

Excavation shall be restricted in size to that which will provide sufficient working space for installation of concrete forms.

Should soil conditions at the bottom of the excavation be unsuitable as a foundation, as determined by the Contracting Officer, the excavation shall be taken down to firm soil and filled to required grade with concrete or satisfactory soil materials as directed.

Excavations shall be performed in a manner to prevent surface, subsurface, and ground water from flowing into the excavation. Excavation work below ground-water level shall require use of pumps or other dewatering methods necessary to convey the water away from the excavation.

Concrete forms shall be constructed of wood, plywood, steel, sonotube or other acceptable materials fabricated to conform to the configuration, line, and grade required. Form work shall be reinforced to prevent deformation while concrete is being placed and consolidated. Form work shall be wetted or coated with a parting agent before placing concrete.

Concrete materials shall be proportioned, mixed, and placed to provide a minimum 28-day compressive strength of 3,000 pounds per square inch.

Anchor bolts shall be galvanized high-strength steel rods with lower deformed 90-degree bend and threaded top conforming to ASTM A 36/A 36M. Anchor rods with exposed threaded ends shall be vertically positioned in the concrete in accordance with the lighting standard manufacturer's recommendations.

Concrete bearing surface shall be leveled and steel troweled to a smooth, hard, dense finish surface.

After form work is removed, the exposed concrete shall be protected with impervious paper or burlap material and kept wet for the full curing period.

Equipment Foundation Data shall be submitted in accordance with referenced standards in this section.

3.2 INSTALLATION

A street-lighting fixture shall be installed at each location indicated, and lamps of the proper type, voltage, and wattage shall be installed in each fixture.

Standards shall be installed on foundations, and their bases shall be leveled so that standards are plumb.

New lamps shall be installed immediately prior to completion of the project. Lamps shall be installed with the light center at the focal point of the reflector and in the proper burning position.

Installation Drawings shall be submitted for the highway and roadway lighting systems. Drawings shall indicate overall physical features, dimensions, ratings, service requirements, and weights of equipment.

Operational Tests shall be performed in accordance with referenced standards within this section.

3.2.1 Field Testing

Street lighting shall be demonstrated to operate satisfactorily in the presence of the Contracting Officer. Demonstration shall take place after sunset.

-- End of Section --

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SECTION 16529

PHOTO CONTROL DEVICES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

IES LM-48 (2001) Guide for Calibration of
Photoelectric Control Devices

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C136.10 (1996) Roadway Lighting
Equipment-Locking-Type Photocontrol
Devices and Mating Receptacles - Physical
and Electrical Interchangeability and
Testing

UNDERWRITERS LABORATORIES (UL)

UL 773 (2002) UL Standard for Safety Plug-In,
Locking Type Photocontrols for Use With
Area Lighting

1.2 GENERAL REQUIREMENTS

Section 16003 GENERAL ELECTRICAL PROVISIONS applies to work specified in this section.

Installation Drawings shall be submitted for light-sensitive control devices in accordance with the manufacturer's recommended instructions for installation.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-03 Product Data

Manufacturer's catalog data shall be submitted for Photoconductive Control Devices.

Installation Drawings shall be submitted for Light-Sensitive Control Devices in accordance with paragraph entitled, "General

Requirements," of this section.

SD-06 Test Reports

Test reports shall be submitted for System Operation Tests in the presence of the Contracting Officer.

SD-08 Manufacturer's Instructions

Operational instructions shall be submitted for Light-Sensitive Control Devices consisting of the manufacturer's recommended procedures for operation.

PART 2 PRODUCTS

2.1 PHOTOCONDUCTIVE CONTROL DEVICES

Photoelectric control devices shall be in accordance with [IEEE C136.10 and] UL 773.

Photoconductive control devices for natural daylight and darkness control of outdoor lighting luminaires shall include a photoconductive cell, thermal actuator, snap-action switch in a weatherproof housing.

Switch mechanism shall consist of a heavy-duty general-purpose precision snap-acting switch. Switch shall be single-pole, single-throw, with a minimum rating of 1,000-watts incandescent-lamp load and 1,200-volt-amperes reactive for vapor-lamp load at rated voltage and frequency.

Time delay in excess of 5 seconds shall be an available option.

Housing for light-sensitive control devices shall be molded from translucent butyrate or acrylic plastic materials and shall be fastened to the base with screws.

Control device, when attached to its mounting, shall be weatherproof and constructed to exclude beating rain, snow, dust, and insects and shall be capable of withstanding 96 percent relative humidity at 122 degrees F for 48 hours under operating conditions.

Light-sensitive control devices shall be physically and electrically interchangeable with three-pole, 3-wire locking plug and receptacle connections to the line, load, and neutral conductors of the lighting circuit.

Device shall turn on within the limits of plus 100 to minus 50 percent of its setting, over a range of input voltage from 105 to 130 volts at rated frequency and ambient temperature, and at rated voltage and frequency over a range of temperature from minus 85 to 122 degrees F, with relative humidities up to 96-percent throughout the temperature range.

Device shall be adjusted to operate within the limits of 0.8 to 1.2 foot-candles, but shall be capable of calibration of the turn-on light level over a minimum range from 0.5 to 3.0 foot-candles, and shall be

adaptable for calibration up to 10 foot-candles. Ratio of turn-off light level to turn-on light level shall not exceed 5.

Instrument accuracy shall be maintained by proper calibration in accordance with IES LM-48.

Devices shall be rated at 120 or 277 volts, 60 hertz. Rated ambient temperature shall be 25 plus or minus 5 degrees C.

PART 3 EXECUTION

3.1 INSTALLATION

Photoconductive control devices shall be installed in accordance with the manufacturer's installation instructions.

3.2 FIELD TESTING

Photoconductive control devices shall be demonstrated to operate satisfactorily in the presence of the Contracting Officer.

System Operation Tests shall be performed in accordance with referenced standards in this section.

-- End of Section --

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SECTION 16535

EMERGENCY LIGHTING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2003) Life Safety Code (National Fire Codes, Vol 5)

NFPA 70 (2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 924 (1995; 8th Ed; Rev thru July 2001)) UL Standard for Safety Emergency Lighting and Power Equipment

1.2 GENERAL REQUIREMENTS

Section 16003 GENERAL ELECTRICAL PROVISIONS applies to work specified in this section.

Material, Equipment, and Fixture Lists shall be submitted showing manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

SD-02 Shop Drawings

Installation drawings shall be submitted for the Central Emergency Lighting Systems indicating location of installed fixture.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Emergency Lighting Egress Units
Emergency Fluorescent Lighting
Accessories

SD-06 Test Reports

Test reports shall be submitted showing results of System Operational Tests for emergency lighting systems.

SD-07 Certificates

Certificates shall be submitted for the following showing conformance with the referenced standards contained in this section.

Emergency Lighting Egress Units
Emergency Fluorescent Lighting
Accessories

PART 2 PRODUCTS

2.1 PRODUCT STANDARDS

Emergency lighting units shall conform to UL 924 and NFPA 101.

Emergency lighting units shall be furnished completely assembled with wiring and mounting devices and ready for installation at the locations indicated. Fixtures shall be equipped with lamps.

2.2 EMERGENCY LIGHTING EGRESS UNITS

Emergency lighting units shall be complete self-contained units with batteries, battery charger, one or more local or remote lamp heads with lamps, under-voltage relay, indicator lights, on/off switch, and test switch, in accordance with UL 924 for Type I (emergency light set), Class I (rechargeable storage-battery-powered unit), Style D (nonrefillable nickel-cadmium battery), as indicated.

Batteries shall be rated not less than 6-12 volts.

Battery charger shall include a dry-type full-wave rectifier with two charging rates, one to automatically maintain the battery in a fully charged state under normal conditions and the other to automatically recharge the battery to a fully charged state within 12 hours after continuous discharge of 1-1/2 hours through the connected lampload.

Batteries shall have capacity and rating to supply the lamp load with maintained 87.5-percent power, minimum, for 1.5 hours, or the battery-lamp combination shall maintain 60-percent, minimum, illumination. Batteries shall be maintenance-free nickel-cadmium type. Minimum normal life shall be 10 years.

Unit enclosure shall be fabricated from sheet steel not less than 18 gage. Cover shall provide access to the battery and battery-charger compartments and shall have a full-length piano hinge and a latching device. Component parts within the enclosure shall be protected from dust, moisture, and oxidizing fumes from the battery. Interior and exterior surfaces of enclosure shall be coated with a corrosion-resistant gray baked-enamel finish.

Lampheads shall be mounted on the top or wall mounted, of the unit enclosure except where otherwise indicated and shall be fully adjustable in the horizontal and vertical planes. The lamphead mounting assembly shall be steel construction with nickel plating. Exterior housing of the lamp shall be formed from nickel-plated sheet steel.

Lamps shall be the sealed-beam type PAR-36 halogen, rated not less than 12 watts at the specified dc voltage.

An amber "ready-for-use on alternating current" indicating light, a red "recharging on alternating current" indicating light, and a momentary-contact pushbutton test switch shall be mounted on the cover of the unit enclosure. The amber indicating light shall indicate, when illuminated, that the unit is electrically connected to the normal ac supply source and that the battery is fully charged. The red indicating light shall indicate, when illuminated, that the battery is being recharged. The momentary-contact pushbutton test switch shall transfer unit from normal supply to battery supply and shall test operation of equipment under simulated ac source power failure.

The under-voltage relay shall be the self-clearing type and shall automatically connect the lampload to the battery supply upon failure of the alternating current supply. An on-off toggle switch shall be mounted inside the unit enclosure to disconnect the battery from the lampload when the unit is taken out of service for maintenance purposes. The relay shall energize when the ac supply falls to 70 percent of normal voltage.

Emergency lighting units shall be provided with angle iron mounting shelves and with a protective screen designed by the equipment manufacturer for this purpose. The mounting shelf and screen shall be coated with a corrosion-resistant finish in accordance with manufacturer's standard practice.

Emergency lighting units shall be suitable for operation on the ac supply circuit to which they are to be electrically connected.

2.3 EMERGENCY FLUORESCENT LIGHTING

Each unit shall have an automatic power failure device, test switch, pilot light, and fully automatic high/low trickle charger in a self-contained solid-state, temperature-compensated power-pack. The battery shall be gelled-electrolyte type with capacity as required to supply power to provide a minimum of 1100 lumens using a 32-watt rapid start lamp. The battery shall be sealed and maintenance-free for a period of not less than 10 years under normal operating conditions.

PART 3 EXECUTION

3.1 INSTALLATION

Emergency lighting unit shall be permanently fixed in place and shall have wiring to each unit installed in accordance with NFPA 70. The branch circuit feeding the unit equipment shall be the same panel bus or branch circuit as that serving the normal lighting in the area and shall be connected ahead of area switches. Emergency lighting fixtures that are remotely connected to the emergency lighting unit shall have circuit wiring kept independent of all other wiring and equipment and shall not enter the same conduit, cable, box, or cabinet with other wiring unless the fixture is supplied from two sources.

Mounting heights of emergency lighting units and remote lamps shall be a minimum of 7-feet above the finished floor.

3.2 FIELD TESTING

Emergency lighting units shall be demonstrated to operate satisfactorily in the presence of the Contracting Officer.

System Operational Tests shall be performed in accordance with referenced standards in this section.

-- End of Section --

SECTION 16710

BUILDING TELECOMMUNICATIONS CABLING SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 709 (2001) Laminated Thermosetting Materials

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA-310-D (1992) Cabinets, Racks, Panels, and Associated Equipment (ANSI/EIA/310-D)

EIA TIA/EIA-526-7 (1998) OFSTP-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant (ANSI/TIA/EIA-526-7)

EIA TIA/EIA-526-14A (1998) OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant (ANSI/TIA/EIA-526-14A)

EIA TIA/EIA-568-B.1 (2001; Addendum 2001) Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements (ANSI/TIA/EIA-568-B.1)

EIA TIA/EIA-568-B.2 (2001; Addenda 2001, 2002) Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components (ANSI/TIA/EIA-568-B.2)

EIA TIA/EIA-568-B.3 (2000; Addendum 2002) Optical Fiber Cabling Components Standard (ANSI/TIA/EIA-568-B.3)

EIA TIA/EIA-569-A (1998; Addenda 2000, 2001) Commercial Building Standards for Telecommunications Pathways and Spaces (ANSI/TIA/EIA-569-A)

EIA TIA/EIA-570-B (2004) Residential Telecommunications Infrastructure

EIA TIA/EIA-606-A (2002) Administration Standard for the Telecommunications Infrastructure

(ANSI/TIA/EIA-606)

TIA J-STD-607-A (2002) Commercial Building Grounding
(Earthing) and Bonding Requirements for
Telecommunications

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE Std 100 (2000) IEEE Standard Dictionary of
Electrical and Electronics Terms

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 68 Connection of Terminal Equipment to the
Telephone Network (47 CFR 68)

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-90-661 (2002) Category 3, 5 and 5e Individually
Unshielded Twisted Pair Indoor Cables for
Use in General Purpose and LAN
Communications Wiring Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA WC 63.1 (2000) Twisted Pair Premise Voice and Data
Communications Cables

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 50 (1995; R 1999, Bul. 2001) Enclosures for
Electrical Equipment

UL 444 (2002; Bul. 2002, 2003) Communications
Cables

UL 467 (1993; R 2001) Grounding and Bonding
Equipment

UL 514C (1996; R 2001) Nonmetallic Outlet Boxes,
Flush-Device Boxes, and Covers

UL 969 (1995; R 2001) Marking and Labeling Systems

UL 1863 (2000; Bul. 2001) Communications Circuit
Accessories

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3, EIA TIA/EIA-569-A, EIA TIA/EIA-606-A and IEEE Std 100 and herein.

1.2.1 Campus Distributor (CD)

A distributor from which the campus backbone cabling emanates. (International expression for main cross-connect (MC).)

1.2.2 Building Distributor (BD)

A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made. (International expression for intermediate cross-connect (IC).)

1.2.3 Floor Distributor (FD)

A distributor used to connect horizontal cable and cabling subsystems or equipment. (International expression for horizontal cross-connect (HC).)

1.2.4 Telecommunications Room (TR)

An enclosed space for housing telecommunications equipment, cable, terminations, and cross-connects. The room is the recognized cross-connect between the backbone cable and the horizontal cabling.

1.2.5 Entrance Facility (EF) (Telecommunications)

An entrance to the building for both private and public network service cables (including antennae) including the entrance point at the building wall and continuing to the entrance room or space.

1.2.6 Entrance Room (ER) (Telecommunications)

A centralized space for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity.

1.2.7 Open Cable

Cabling that is not run in a raceway as defined by NFPA 70. This refers to cabling that is "open" to the space in which the cable has been installed and is therefore exposed to the environmental conditions associated with that space.

1.2.8 Open Office

A floor space division provided by furniture, moveable partitions, or other means instead of by building walls.

1.2.9 Pathway

A physical infrastructure utilized for the placement and routing of

telecommunications cable.

1.3 SYSTEM DESCRIPTION

The building telecommunications cabling and pathway system shall include permanently installed backbone and horizontal cabling, horizontal and backbone pathways, service entrance facilities, work area pathways, telecommunications outlet assemblies, conduit, raceway, and hardware for splicing, terminating, and interconnecting cabling necessary to transport telephone and data (including LAN) between equipment items in a building. The horizontal system shall be wired in a star topology from the telecommunications work area to the floor distributor or campus distributor at the center or hub of the star. The backbone cabling and pathway system includes intrabuilding and interbuilding interconnecting cabling, pathway, and terminal hardware. The intrabuilding backbone provides connectivity from the floor distributors to the building distributors or to the campus distributor and from the building distributors to the campus distributor as required. The backbone system shall be wired in a star topology with the campus distributor at the center or hub of the star. The interbuilding backbone system provides connectivity between the campus distributors. Provide telecommunications pathway systems referenced herein and as shown on plans. The telecommunications contractor must coordinate with the NMCI contractor concerning access to and configuration of telecommunications spaces. The telecommunications contractor may be required to coordinate work effort within the telecommunications spaces with the NMCI contractor.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are[for information only.][for Contractor Quality Control approval.] When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Telecommunications drawings; G.

Telecommunications Space Drawings; G.

In addition to Section 01330 SUBMITTAL PROCEDURES, provide shop drawings in accordance with paragraph SHOP DRAWINGS.

SD-03 Product Data

Telecommunications cabling (backbone and horizontal); G.

Patch panels; G.

Telecommunications outlet/connector assemblies; G.

Equipment support frame; G.

Connector blocks; G.

Submittals shall include the manufacturer's name, trade name, place of manufacture, and catalog model or number. Include performance and characteristic curves. Submittals shall also include applicable federal, military, industry, and technical society publication references. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified in paragraph REGULATORY REQUIREMENTS and as required in Section 01330 SUBMITTAL PROCEDURES.

SD-06 Test Reports

Telecommunications cabling testing; G.

SD-07 Certificates

Telecommunications Contractor Qualifications; G.

Key Personnel Qualifications; G.

Manufacturer Qualifications; G.

Test plan; G.

SD-09 Manufacturer's Field Reports

Factory reel tests; G.

SD-10 Operation and Maintenance Data

Telecommunications cabling and pathway system Data Package 5; G.

SD-11 Closeout Submittals

Record Documentation; G.

1.5 QUALITY ASSURANCE

1.5.1 Shop Drawings

In exception to Section 01330, SUBMITTAL PROCEDURES, submit shop drawings a minimum of 14 by 20 inches in size using a minimum scale of 1/8 inch per foot. Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Submittals shall include the nameplate data, size, and capacity. Submittals shall also include applicable federal, military, industry, and technical society publication references.

1.5.1.1 Telecommunications Drawings

Provide drawings in accordance with EIA TIA/EIA-606-A. The identifier for each termination and cable shall appear on the drawings. Drawings shall depict final telecommunications installed wiring system infrastructure in accordance with EIA TIA/EIA-606-A. The drawings should provide details required to prove that the distribution system shall properly support connectivity from the EF telecommunications and ER telecommunications, CD's, BD's, and FD's to the telecommunications work area outlets. Provide a plastic laminated schematic of the as-installed telecommunications cable system showing cabling, CD's, BD's, FD's, and the EF and ER for telecommunications keyed to floor plans by room number. Mount the laminated schematic in the EF telecommunications space as directed by the Contracting Officer. The following drawings shall be provided as a minimum:

- a. T1 - Layout of complete building per floor - Building Area/Serving Zone Boundaries, Backbone Systems, and Horizontal Pathways. Layout of complete building per floor. The drawing indicates location of building areas, serving zones, vertical backbone diagrams, telecommunications rooms, access points, pathways, grounding system, and other systems that need to be viewed from the complete building perspective.
- b. T2 - Serving Zones/Building Area Drawings - Drop Locations and Cable Identification (ID'S). Shows a building area or serving zone. These drawings show drop locations, telecommunications rooms, access points and detail call outs for common equipment rooms and other congested areas.
- c. T4 - Typical Detail Drawings - Faceplate Labeling, Firestopping, Americans with Disabilities Act (ADA), Safety, Department of Transportation (DOT). Detailed drawings of symbols and typicals such as faceplate labeling, faceplate types, faceplate population installation procedures, detail racking, and raceways.

1.5.1.2 Telecommunications Space Drawings

Provide T3 drawings in accordance with EIA TIA/EIA-606-A that include telecommunications rooms plan views, pathway layout (cable tray, racks, ladder-racks, etc.), mechanical/electrical layout, and cabinet, rack, backboard and wall elevations. Drawings shall show layout of applicable equipment including incoming cable stub or connector blocks, building protector assembly, outgoing cable connector blocks, patch panels and equipment spaces and cabinet/racks. Drawings shall include a complete list of equipment and material, equipment rack details, proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation. Drawings may also be an enlargement of a congested area of T1 or T2 drawings.

1.5.2 Telecommunications Qualifications

Work under this section shall be performed by and the equipment shall be

provided by the approved telecommunications contractor and key personnel. Qualifications shall be provided for: the telecommunications system contractor, the telecommunications system installer, and the supervisor (if different from the installer). A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

1.5.2.1 Telecommunications Contractor

The telecommunications contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified telecommunications systems and equipment. The telecommunications contractor shall demonstrate experience in providing successful telecommunications systems within the past 3 years. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor.

1.5.2.2 Key Personnel

Provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. There may be one key person or more key persons proposed for this solicitation depending upon how many of the key roles each has successfully provided. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems within the past 3 years.

Supervisors and installers assigned to the installation of this system or any of its components shall be Building Industry Consulting Services International (BICSI) Registered Cabling Installers, Technician Level. Submit documentation of current BICSI certification for each of the key personnel.

Indicate that all key persons are currently employed by the telecommunications contractor, or have a commitment to the telecommunications contractor to work on this project. All key persons shall be employed by the telecommunications contractor at the date of issuance of this solicitation, or if not, have a commitment to the telecommunications contractor to work on this project by the date that the bid was due to the Contracting Officer.

Note that only the key personnel approved by the Contracting Officer in the successful proposal shall do work on this solicitation's telecommunications system. Key personnel shall function in the same roles in this contract, as they functioned in the offered successful experience. Any substitutions for the telecommunications contractor's key personnel requires approval from The Contracting Officer.

1.5.2.3 Minimum Manufacturer Qualifications

Cabling, equipment and hardware manufacturers shall have a minimum of 3 years experience in the manufacturing, assembly, and factory testing of components which comply with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2 and

EIA TIA/EIA-568-B.3.

1.5.3 Test Plan

Provide a complete and detailed test plan for the telecommunications cabling system including a complete list of test equipment for the UTP and optical fiber components and accessories 60 days prior to the proposed test date. Include procedures for certification, validation, and testing.

1.5.4 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.5.5 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.5.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.5.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.6 DELIVERY AND STORAGE

Provide protection from weather, moisture, extreme heat and cold, dirt, dust, and other contaminants for telecommunications cabling and equipment placed in storage.

1.7 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, noncondensing.

1.8 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.9 MAINTENANCE

1.9.1 Operation and Maintenance Manuals

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance of products provided as a part of the telecommunications cabling and pathway system. Submit operations and maintenance data in accordance with Section 01781, OPERATION AND MAINTENANCE DATA and as specified herein not later than 2 months prior to the date of beneficial occupancy. In addition to requirements of Data package 5, include the requirements of paragraphs TELECOMMUNICATIONS DRAWINGS, TELECOMMUNICATIONS SPACE DRAWINGS, and RECORD DOCUMENTATION.

1.9.2 Record Documentation

Provide T5 drawings including documentation on cables and termination hardware in accordance with EIA TIA/EIA-606-A. T5 drawings shall include schedules to show information for cut-overs and cable plant management, patch panel layouts and cover plate assignments, cross-connect information and connecting terminal layout as a minimum. T5 drawings shall be provided in hard copy format. Provide the following T5 drawing documentation as a minimum:

- a. Cables - A record of installed cable shall be provided in accordance with EIA TIA/EIA-606-A. The cable records shall include the required data fields for each cable and complete end-to-end circuit report for each complete circuit from the assigned outlet to the entry facility in accordance with EIA TIA/EIA-606-A. Include manufacture date of cable with submittal.
- b. Termination Hardware - A record of installed patch panels, cross-connect points, distribution frames, terminating block arrangements and type, and outlets shall be provided in accordance with EIA TIA/EIA-606-A. Documentation shall include the required data fields as a minimum in accordance with EIA TIA/EIA-606-A.

PART 2 PRODUCTS

2.1 COMPONENTS

UL or third party certified. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations, submit proof of such compliance. The label or listing by

the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard. Provide a complete system of telecommunications cabling and pathway components using star topology. Provide support structures and pathways, complete with outlets, cables, connecting hardware and telecommunications cabinets/racks. Cabling and interconnecting hardware and components for telecommunications systems shall be UL listed or third party independent testing laboratory certified, and shall comply with NFPA 70 and conform to the requirements specified herein.

2.2 TELECOMMUNICATIONS PATHWAY

Provide telecommunications pathways in accordance with EIA TIA/EIA-569-A and as specified.

2.3 TELECOMMUNICATIONS CABLING

Cabling shall be UL listed for the application and shall comply with EIA TIA/EIA-568-B.1 and NFPA 70. Provide a labeling system for cabling as required by EIA TIA/EIA-606-A and UL 969. Ship cable in boxes bearing manufacture date for UTP in accordance with ICEA S-90-661[and optical fiber cables in accordance with ICEA S-83-596] for all cable used on this project. Cabling manufactured more than 12 months prior to date of installation shall not be used.

2.3.1 Backbone Cabling

2.3.1.1 Backbone Copper

ICEA S-90-661, EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, NEMA WC 63.1 and UL 444, copper backbone cable shall be solid conductor, 24 AWG, 100 ohm, 50-pair UTP (Unshielded twisted pair), formed into 25 pair binder groups covered with a gray thermoplastic jacket. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) at regular intervals not to exceed 2 feet. The word "FEET" or the abbreviation "FT" shall appear after each length marking. Provide communications general purpose (CM or CMG), communications plenum (CMP) or communications riser (CMR) rated cabling in accordance with NFPA 70. Type CMP and CMR may be substituted for type CM or CMG and type CMP may be substituted for type CMR in accordance with NFPA 70. Color coding shall comply with industry standards for 25 pair cables.

2.3.2 Horizontal Cabling

Provide horizontal cable in compliance with NFPA 70 and performance characteristics in accordance with EIA TIA/EIA-568-B.1.

2.3.2.1 Horizontal Copper

Provide horizontal copper cable in accordance with EIA TIA/EIA-568-B.2, UL 444, NEMA WC 63.1, ICEA S-90-661 UTP (unshielded twisted pair), 100 ohm. Provide four each individually twisted pair, 24 AWG conductors, Category 5e, with a blue thermoplastic jacket. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) at regular intervals not to exceed 2 feet. The word "FEET" or the abbreviation "FT" shall appear after each length marking. Provide communications general purpose (CM or CMG), communications plenum (CMP) or communications riser (CMR) rated cabling in accordance with NFPA 70. Type CMP and CMR may be substituted for type CM or CMG and type CMP may be substituted for type CMR in accordance with NFPA 70. Provide Category 5e cabling in accordance with EIA TIA/EIA-570-B.

2.3.3 Work Area Cabling

2.3.3.1 Work Area Copper

Provide work area copper cable in accordance with EIA TIA/EIA-568-B.2, with a blue, thermoplastic jacket.

2.3.4 Building Protector Assemblies

Provide self-contained 5 pin unit supplied with a field cable stub factory connected to protector socket blocks to terminate and accept protector modules for 100 pairs of outside cable. Building protector assembly shall have interconnecting hardware for connection to interior cabling at full capacity. Provide manufacturers instructions for building protector assembly installation. Provide copper cable interconnecting hardware as specified in this section.

2.3.5 Protector Modules

Provide in accordance with UL 497 three-electrode gas tube or solid state type 5 pin rated for the application. Provide gas tube protection modules in accordance with RUS Bul 345-83 and shall be heavy duty, $A > 10\text{kA}$, $B > 400$, $C > 65\text{A}$ where A is the maximum single impulse discharge current, B is the impulse life and C is the AC discharge current in accordance with NEMA C62.61. The gas modules shall shunt high voltage to ground, fail short, and be equipped with an external spark gap and heat coils in accordance with UL 497. provide the number of surge protection modules equal to the number of pairs of exterior cable of the building protector assembly.

2.4 TELECOMMUNICATIONS SPACES

Provide connecting hardware and termination equipment in the telecommunications entrance facility[and telecommunication equipment room[s]] to facilitate installation as shown on design drawings for terminating and cross-connecting permanent cabling. Provide telecommunications interconnecting hardware color coding in accordance with EIA TIA/EIA-606-A.

2.4.1 Backboards

Provide void-free, interior grade plywood 3/4 inch thick 4 by 8 feet. Backboards shall be fire rated. Backboards shall be provided on a minimum of two walls in the telecommunication spaces. Do not cover the fire stamp on the backboard.

2.4.2 Equipment Support Frame

Provide in accordance with EIA-310-D and UL 50.

- a. Racks, floor mounted modular type, 16 gauge steel construction, minimum, treated to resist corrosion. Provide rack with vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug and a surge protected power strip with 6 duplex 20 amp receptacles. Rack shall be compatible with 19 inch.

2.4.3 Connector Blocks

Provide insulation displacement connector (IDC) Type 110 for Category 5e and higher Type 66 for Category 5e systems. Provide blocks for the number of horizontal and backbone cables terminated on the block plus 25 percent spare.

2.4.4 Cable Guides

Provide cable guides specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on 19 inch equipment racks and telecommunications backboards. Cable guides of ring or bracket type devices mounted on rack backboard for horizontal cable management and individually mounted for vertical cable management. Mount cable guides with screws, and lockwashers.

2.4.5 Patch Panels

Provide ports for the number of horizontal and backbone cables terminated on the panel plus 25 percent spare. Provide pre-connectorized optical fiber and copper patch cords for patch panels. Provide patch cords, as complete assemblies, with matching connectors as specified. Patch cords shall meet minimum performance requirements specified in EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2 and EIA TIA/EIA-568-B.3 for cables, cable length and hardware specified.

2.4.5.1 Modular to 110 Block Patch Panel

Provide in accordance with EIA TIA/EIA-568-B.1 and EIA TIA/EIA-568-B.2. Panels shall be third party verified and shall comply with EIA/TIA Category 5e requirements. Panel shall be constructed of 0.09 inch minimum aluminum and shall be rack mounted and compatible with an EIA-310-D 19 inch equipment rack. Panel shall provide 48 non-keyed, 8-pin modular ports, wired to T568A. Patch panels shall terminate the building cabling on Type 110 IDCs and shall utilize a printed circuit board interface. The rear of each panel shall have incoming cable strain-relief and routing guides. Panels shall have each port factory numbered and be equipped with laminated plastic nameplates above each port.

2.5 TELECOMMUNICATIONS OUTLET/CONNECTOR ASSEMBLIES

2.5.1 Outlet/Connector Copper

Outlet/connectors shall comply with FCC Part 68 EIA TIA/EIA-568-B.1, and EIA TIA/EIA-568-B.2. UTP outlet/connectors shall be UL 1863 listed, non-keyed, 8-pin modular, constructed of high impact rated thermoplastic housing and shall be third party verified[and shall comply with EIA TIA/EIA-568-B.2 Category 5 requirements. Outlet/connectors provided for UTP cabling shall meet or exceed the requirements for the cable provided. Outlet/connectors shall be terminated using a Type 110 IDC PC board connector, color-coded for both T568A and T568B wiring. Each outlet/connector shall be wired T568A. UTP outlet/connectors shall comply with EIA TIA/EIA-568-B.2 for 200 mating cycles.

2.5.2 Cover Plates

Telecommunications cover plates shall comply with UL 514C, and EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3; flush design constructed of high impact thermoplastic material in color to match color of receptacle/switch cover plates specified in Section 16402 INTERIOR DISTRIBUTION SYSTEMS. Provide labeling in accordance with the paragraph LABELING in this section.

2.6 TERMINAL CABINETS

Construct of zinc-coated sheet steel, 36 by 24 by 6 inches deep. Trim shall be fitted with hinged door and locking latch. Doors shall be maximum size openings to box interiors. Boxes shall be provided with 5/8 inch backboard with two-coat varnish finish. Match trim, hardware, doors, and finishes with panelboards. Provide label and identification systems for telecommunications wiring and components consistent with EIA TIA/EIA-606-A.

2.7 GROUNDING AND BONDING PRODUCTS

Provide in accordance with UL 467, TIA J-STD-607-A, and NFPA 70. Components shall be identified as required by EIA TIA/EIA-606-A. Provide ground rods, bonding conductors, and grounding busbars as specified.

2.8 FIRESTOPPING MATERIAL

Provide as specified in Section 07840, FIRESTOPPING.

2.9 FIELD FABRICATED NAMEPLATES

ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

2.10 TESTS, INSPECTIONS, AND VERIFICATIONS

2.10.1 Factory Reel Tests

Provide documentation of the testing and verification actions taken by manufacturer to confirm compliance with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.3, EIA TIA/EIA-526-7 for single mode optical fiber, and EIA TIA/EIA-526-14A for multimode optical fiber cables.

PART 3 EXECUTION

3.1 INSTALLATION

Install telecommunications cabling and pathway systems, including the horizontal and backbone cable, pathway systems, telecommunications outlet/connector assemblies, and associated hardware in accordance with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, [EIA TIA/EIA-568-B.3,]EIA TIA/EIA-569-A, NFPA 70, and UL standards as applicable. Provide cabling in a star topology network. Pathways and outlet boxes shall be installed as specified. Install telecommunications cabling with copper media in accordance with the following criteria to avoid potential electromagnetic interference between power and telecommunications equipment. The interference ceiling shall not exceed 3.0 volts per meter measured over the usable bandwidth of the telecommunications cabling.[Cabling shall be run with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.]

3.1.1 Cabling

Install Category 5e UTP, and optical fiber telecommunications cabling system as detailed in EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, and EIA TIA/EIA-568-B.3. Screw terminals shall not be used except where specifically indicated on plans. Use an approved insulation displacement connection (IDC) tool kit for copper cable terminations. Do not untwist Category 5e UTP cables more than one half inch from the point of termination to maintain cable geometry. Provide service loop on each end of the cable, 10 ft. in the telecommunications room, and 12 inches in the work area outlet. Do not exceed manufacturers' cable pull tensions for copper and optical fiber cables. Provide a device to monitor cable pull tensions. Do not exceed 25 pounds pull tension for four pair copper cables. Do not chafe or damage outer jacket materials. Use only lubricants approved by cable manufacturer. Do not over cinch cables, or crush cables with staples. For UTP cable, bend radii shall not be less than four times the cable diameter. Cables shall be terminated; no cable shall contain unterminated elements. Cables shall not be spliced. Label cabling in accordance with paragraph LABELING in this section.

3.1.1.1 Open Cable

Use only where specifically indicated on plans for use in cable trays. Install in accordance with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2 and EIA TIA/EIA-568-B.3. Do not exceed cable pull tensions recommended by the manufacturer. Copper cable not in a wireway or pathway shall be suspended a minimum of 8 inches above ceilings by cable supports no greater than 48 inches apart. Cable shall not be run through structural members or in

contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided.

- a. Plenum cable shall be used where open cables are routed through plenum areas.

3.1.1.2 Backbone Cable

- a. Copper Backbone Cable. Install intrabuilding backbone copper cable, in indicated pathways, between the campus distributor, located in the telecommunications entrance facility or room, the building distributors and the floor distributors located in telecommunications rooms and telecommunications equipment rooms as indicated on drawings.

3.1.1.3 Horizontal Cabling

Install horizontal cabling as indicated on drawings between the campus distributor, building distributors, floor distributors and the telecommunications outlet assemblies at workstations.

3.1.2 Pathway Installations

Provide in accordance with EIA TIA/EIA-569-A and NFPA 70. Provide building pathway as specified in Section 16402, INTERIOR DISTRIBUTION SYSTEMS.

3.1.3 Service Entrance Conduit, Underground

Provide service entrance underground as specified.

3.1.4 Cable Tray Installation

Install cable tray as specified. Only CMP and OFNP type cable shall be installed in a plenum.

3.1.5 Work Area Outlets

3.1.5.1 Terminations

Terminate UTP cable in accordance with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2 and wiring configuration as specified.

3.1.5.2 Cover Plates

As a minimum, each outlet/connector shall be labeled as to its function and a unique number to identify cable link in accordance with the paragraph LABELING in this section.

3.1.5.3 Cables

Unshielded twisted pair and fiber optic cables shall have a minimum of 12 inches of slack cable loosely coiled into the telecommunications outlet

boxes. Minimum manufacturer's bend radius for each type of cable shall not be exceeded.

3.1.5.4 Pull Cords

Pull cords shall be installed in conduit serving telecommunications outlets that do not have cable installed.

3.1.6 Telecommunications Space Termination

Install termination hardware required for Category 5e, and system. An insulation displacement tool shall be used for terminating copper cable to insulation displacement connectors.

[3.1.6.1 Connector Blocks

Connector blocks shall be rack mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Install in accordance with industry standard wire routing guides in accordance with EIA TIA/EIA-569-A.

3.1.6.2 Patch Panels

Patch panels shall be mounted in equipment racks with sufficient ports to accommodate the installed cable plant plus 25 percent spares.

- [a. Copper Patch Panel. Copper cable entering a patch panel shall be secured to the panel with cable ties to prevent movement of the cable.

3.1.6.3 Equipment Support Frames

Install in accordance with EIA TIA/EIA-569-A:

- a. Racks, floor mounted modular type. Permanently anchor rack to the floor in accordance with manufacturer's recommendations.

3.1.7 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings as specified in Section 07840, FIRESTOPPING.

3.1.8 Grounding and Bonding

Provide in accordance with TIA J-STD-607-A, NFPA 70 and as specified.

3.2 LABELING

3.2.1 Labels

Provide labeling in accordance with EIA TIA/EIA-606-A. Handwritten labeling is unacceptable. Stenciled lettering for voice and data circuits shall be provided using laser printer.

3.2.2 Cable

Cables shall be labeled using color labels on both ends with identifiers in accordance with EIA TIA/EIA-606-A.

3.2.3 Termination Hardware

Workstation outlets and patch panel connections shall be labeled using color coded labels with identifiers in accordance with EIA TIA/EIA-606-A.

3.3 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09900 PAINTS AND COATINGS.

3.4 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.5 TESTING

3.5.1 Telecommunications Cabling Testing

Perform telecommunications cabling inspection, verification, and performance tests in accordance with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3. Perform optical fiber field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.

3.5.1.1 Inspection

Visually inspect UTP and optical fiber jacket materials for UL or third party certification markings. Inspect cabling terminations in telecommunications rooms and at workstations to confirm color code for T568A or T568B pin assignments, and inspect cabling connections to confirm compliance with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3. Visually confirm Category 5e, marking of outlets, cover plates, outlet/connectors, and patch panels.

3.5.1.2 Verification Tests

UTP backbone copper cabling shall be tested for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has overall shield. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connected.

For multimode optical fiber, perform optical fiber end-to-end attenuation tests in accordance with EIA TIA/EIA-568-B.3 and EIA TIA/EIA-526-14A using Method A, Optical Power Meter and Light Source for multimode optical fiber.

For single-mode optical fiber, perform optical fiber end-to-end attenuation tests in accordance with EIA TIA/EIA-568-B.3 and EIA TIA/EIA-526-7 using Method A, Optical Power Meter and Light Source for single-mode optical fiber. Perform verification acceptance tests.

3.5.1.3 Performance Tests

Perform testing for each outlet and MUTOA as follows:

- a. Perform Category 5e link tests in accordance with EIA TIA/EIA-568-B.1 and EIA TIA/EIA-568-B.2. Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, propagation delay and delay skew.
- b. Optical fiber Links. Perform optical fiber end-to-end link tests in accordance with EIA TIA/EIA-568-B.3.

3.5.1.4 Final Verification Tests

Perform verification tests for UTP and optical fiber systems after the complete telecommunications cabling and workstation outlet/connectors are installed.

- a. Voice Tests. These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and DSN telephone call.
- b. Data Tests. These tests assume the Information Technology Staff has a network installed and are available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

-- End of Section --

SECTION 16711

TELECOMMUNICATIONS OUTSIDE PLANT (OSP)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B 1	(2001) Hard-Drawn Copper Wire
ASTM B 8	(2004) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D 709	(2001) Laminated Thermosetting Materials

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA TIA/EIA-568-B.1	(2001; Addendum 2001) Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements (ANSI/TIA/EIA-568-B.1)
EIA TIA/EIA-568-B.2	(2001) Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components (ANSI/TIA/EIA-568-B.2)
EIA TIA/EIA-568-B.3	(2000; Addendum 2002) Optical Fiber Cabling Components Standard (ANSI/TIA/EIA-568-B.3)
EIA TIA/EIA-569-A	(1998; Addenda 2000, 2001) Commercial Building Standards for Telecommunications Pathways and Spaces (ANSI/TIA/EIA-569-A)
EIA TIA/EIA-590-A	(1997) Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant
EIA TIA/EIA-606-A	(2002) Administration Standard for the Telecommunications Infrastructure (ANSI/TIA/EIA-606)
EIA TIA/EIA-758	(1999; Addendum 1999) Customer-Owned Outside Plant Telecommunications Cabling Standard (ANSI/TIA/EIA-758)

TIA J-STD-607-A (2002) Commercial Building Grounding
(Earthing) and Bonding Requirements for
Telecommunications

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2002) National Electrical Safety Code

IEEE Std 100 (2000) IEEE Standard Dictionary of
Electrical and Electronics Terms

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-87-640 (1999) Fiber Optic Outside Plant
Communications Cable

ICEA S-98-688 (1997) Broadband Twisted Pair,
Telecommunications Cable Aircore,
Polyolefin Insulated Copper Conductors

ICEA S-99-689 (1997) Broadband Twisted Pair
Telecommunications Cable Filled,
Polyolefin Insulated Copper Conductors

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA C62.61 (1993) Gas Tube Surge Arresters on Wire
Line Telephone Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2005) National Electrical Code

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS 1755 Telecommunications Standards and
Specifications for Materials, Equipment
and Construction

RUS Bul 1751F-630 (2002) Underground Plant Design

RUS Bul 1751F-643 (1996) Design of Aerial Plant

RUS Bul 1751F-815 (1979) Electrical Protection of Outside
Plant

RUS Bul 1753F-201 (1997) Acceptance Tests of
Telecommunications Plant (PC-4)

RUS Bul 1753F-401 (1995) Splicing Copper and Fiber Optic
Cables (PC-2)

RUS Bul 345-50 (1979) Trunk Carrier Systems (PE-60)

RUS Bul 345-65 (1985) Shield Bonding Connectors (PE-65)
RUS Bul 345-72 (1985) Filled Splice Closures (PE-74)
RUS Bul 345-83 (1979; Rev Oct 1982) Gas Tube Surge Arrestors (PE-80)

UNDERWRITERS LABORATORIES (UL)

UL 497 (2001) Protectors for Paired Conductor Communication Circuits
UL 510 (1994; Rev thru Apr 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 83 (2003; Rev thru Mar 2004) Thermoplastic-Insulated Wires and Cables

1.2 RELATED REQUIREMENTS

Section 16710, BUILDING TELECOMMUNICATIONS CABLING SYSTEM, and Section 16375A, ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND apply to this section with additions and modifications specified herein.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3, EIA TIA/EIA-569-A, EIA TIA/EIA-606-A, and IEEE Std 100 and herein.

1.3.1 Campus Distributor (CD)

A distributor from which the campus backbone cabling emanates. (International expression for main cross-connect - (MC).)

1.3.2 Entrance Facility (EF) (Telecommunications)

An entrance to the building for both private and public network service cables (including antennae) including the entrance point at the building wall and continuing to the entrance room or space.

1.3.3 Entrance Room (ER) (Telecommunications)

A centralized space for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity.

1.3.4 Building Distributor (BD)

A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made. (International

expression for intermediate cross-connect - (IC).)

1.3.5 Pathway

A physical infrastructure utilized for the placement and routing of telecommunications cable.

1.4 SYSTEM DESCRIPTION

The telecommunications outside plant consists of cable, conduit, manholes, etc. required to provide signal paths from the closest point of presence to the new facility, including free standing frames or backboards, interconnecting hardware, terminating cables, lightning and surge protection modules at the entrance facility. The work consists of providing, testing and making operational cabling, interconnecting hardware and lightning and surge protection necessary to form a complete outside plant telecommunications system for continuous use. The telecommunications contractor must coordinate with the NMCI contractor concerning layout and configuration of the EF telecommunications and OSP. The telecommunications contractor may be required to coordinate work effort for access to the EF telecommunications and OSP with the NMCI contractor.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Telecommunications Outside Plant; G.

Telecommunications Entrance Facility Drawings; G.

In addition to Section 01330 SUBMITTAL PROCEDURES, provide shop drawings in accordance with paragraph SHOP DRAWINGS.

SD-03 Product Data

Wire and cable; G.

Cable splices, and connectors; G.

Closures; G.

Building protector assemblies; G.

Protector modules; G.

Cross-connect terminal cabinets; G.

Submittals shall include the manufacturer's name, trade name,

place of manufacture, and catalog model or number. Submittals shall also include applicable federal, military, industry, and technical society publication references. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified in paragraph REGULATORY REQUIREMENTS and as required for certificates in Section 01330 SUBMITTAL PROCEDURES.

SD-06 Test Reports

Pre-installation tests; G.

Acceptance tests; G.

Outside Plant Test Plan; G.

SD-07 Certificates

Telecommunications Contractor Qualifications; G.

Key Personnel Qualifications; G.

Minimum Manufacturer's Qualifications; G.

SD-08 Manufacturer's Instructions

Building protector assembly installation; G.

Cable tensions; G.

Submit instructions prior to installation.

SD-09 Manufacturer's Field Reports

Factory Reel Test Data; G.

SD-10 Operation and Maintenance Data

Telecommunications outside plant (OSP), Data Package 5; G.

Commercial off-the-shelf manuals shall be provided for operation, installation, configuration, and maintenance of products provided as a part of the telecommunications outside plant (OSP). Submit operations and maintenance data in accordance with Section 01781, OPERATION AND MAINTENANCE DATA and as specified herein not later than 2 months prior to the date of beneficial occupancy. In addition to requirements of Data package 5, include the requirements of paragraphs TELECOMMUNICATIONS OUTSIDE PLANT SHOP DRAWINGS and TELECOMMUNICATIONS ENTRANCE FACILITY DRAWINGS.

SD-11 Closeout Submittals

Record Documentation; G.

In addition to other requirements, provide in accordance with paragraph RECORD DOCUMENTATION.

1.6 QUALITY ASSURANCE

1.6.1 Shop Drawings

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Submittals shall include the nameplate data, size, and capacity. Submittals shall also include applicable federal, military, industry, and technical society publication references.

1.6.1.1 Telecommunications Outside Plant Shop Drawings

Provide Outside Plant Design in accordance with EIA TIA/EIA-758, RUS Bul 1751F-630 for aerial system design, and RUS Bul 1751F-643 for underground system design. Provide T0 shop drawings that show the physical and logical connections from the perspective of an entire campus, such as actual building locations, exterior pathways and campus backbone cabling on plan view drawings, major system nodes, and related connections on the logical system drawings in accordance with EIA TIA/EIA-606-A. Drawings shall include wiring and schematic diagrams for fiber optic and copper cabling and splices, copper conductor gauge and pair count, fiber pair count and type, pathway duct and innerduct arrangement, associated construction materials, and any details required to demonstrate that cable system has been coordinated and will properly support the switching and transmission system identified in specification and drawings. Provide Registered Communications Distribution Designer (RCDD) approved drawings of the telecommunications outside plant. The telecommunications outside plant (OSP) shop drawings shall be included in the operation and maintenance manuals.

1.6.1.2 Telecommunications Entrance Facility Drawings

Provide T3 drawings for EF Telecommunications in accordance with EIA TIA/EIA-606-A that include telecommunications entrance facility plan views, pathway layout (cable tray, racks, ladder-racks, etc.), mechanical/electrical layout, and cabinet, backboard and wall elevations. Drawings shall show layout of applicable equipment including incoming cable stub or connector blocks, building protector assembly, outgoing cable connector blocks, patch panels and equipment spaces and cabinet/racks. Drawings shall include a complete list of equipment and material, equipment rack details, proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation. Drawings may also be an enlargement of a congested area of T1 or T2 drawings. The telecommunications entrance facility shop drawings shall be included in the operation and maintenance manuals.

1.6.2 Telecommunications Qualifications

Work under this section shall be performed by and the equipment shall be provided by the approved telecommunications contractor and key personnel. Qualifications shall be provided for: the telecommunications system contractor, the telecommunications system installer, the supervisor (if different from the installer), and the cable splicing and terminating personnel. A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

1.6.2.1 Telecommunications Contractor Qualifications

The telecommunications contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified telecommunications systems and equipment. The telecommunications contractor shall demonstrate experience in providing successful telecommunications systems that include outside plant and broadband cabling within the past 3 years. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems in accordance with EIA TIA/EIA-758 within the past 3 years.

1.6.2.2 Key Personnel Qualifications

Provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. There may be one key person or more key persons proposed for this solicitation depending upon how many of the key roles each has successfully provided. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems within the past 3 years.

Cable splicing and terminating personnel assigned to the installation of this system or any of its components shall have training in the proper techniques and have a minimum of 3 years experience in splicing and terminating the specified cables. Modular splices shall be performed by factory certified personnel or under direct supervision of factory trained personnel for products used.

Supervisors and installers assigned to the installation of this system or any of its components shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products.

Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for each of the key personnel. Documentation for each key person shall include at least two successful system installations provided that are equivalent in system size and in construction complexity to the telecommunications system proposed for this solicitation. Include specific experience in installing and testing telecommunications outside plant systems, including broadband

cabling, and provide the names and locations of at least two project installations successfully completed using copper telecommunications cabling systems. All of the existing telecommunications system installations offered by the key persons as successful experience shall have been in successful full-time service for at least 18 months prior to the issuance date for this solicitation. Provide the name and role of the key person, the title, location, and completed installation date of the referenced project, the referenced project owner point of contact information including name, organization, title, and telephone number, and generally, the referenced project description including system size and construction complexity.

Indicate that all key persons are currently employed by the telecommunications contractor, or have a commitment to the telecommunications contractor to work on this project. All key persons shall be employed by the telecommunications contractor at the date of issuance of this solicitation, or if not, have a commitment to the telecommunications contractor to work on this project by the date that the bid was due to the Contracting Officer.

Note that only the key personnel approved by the Contracting Officer in the successful proposal shall do work on this solicitation's telecommunications system. Key personnel shall function in the same roles in this contract, as they functioned in the offered successful experience. Any substitutions for the telecommunications contractor's key personnel requires approval from The Contracting Officer.

1.6.2.3 Minimum Manufacturer's Qualifications

Cabling, equipment and hardware manufacturers shall have a minimum of 3 years experience in the manufacturing, assembly, and factory testing of components which comply with, EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2 and EIA TIA/EIA-568-B.3. In addition, cabling manufacturers shall have a minimum of 3 years experience in the manufacturing and factory testing of cabling which comply with ICEA S-87-640, ICEA S-98-688, and ICEA S-99-689.

1.6.3 Outside Plant Test Plan

Prepare and provide a complete and detailed test plan for field tests of the outside plant including a complete list of test equipment for the copper conductor cables, components, and accessories for approval by the Contracting Officer. Include a cut-over plan with procedures and schedules for relocation of facility station numbers without interrupting service to any active location. Submit the plan at least 30 days prior to tests for Contracting Officer approval. Provide outside plant testing and performance measurement criteria in accordance with EIA TIA/EIA-568-B.1 and RUS Bul 1753F-201. Include procedures for certification, validation, and testing that includes fiber optic link performance criteria.

1.6.4 Standard Products

Provide materials and equipment that are standard products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship and shall be the manufacturer's latest

standard design that has been in satisfactory commercial or industrial use for at least 1 year prior to bid opening. The 1-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 1-year period. Products supplied shall be specifically designed and manufactured for use with outside plant telecommunications systems. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.6.4.1 Alternative Qualifications

Products having less than a 1-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 3000 hours, exclusive of the manufacturers' factory or laboratory tests, is provided.

1.6.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.6.5 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.6.5.1 Independent Testing Organization Certificate

In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.7 DELIVERY, STORAGE, AND HANDLING

Ship cable on reels in 1200 feet length with a minimum overage of 10 percent. Radius of the reel drum shall not be smaller than the minimum bend radius of the cable. Wind cable on the reel so that unwinding can be done without kinking the cable. Two meters of cable at both ends of the cable shall be accessible for testing. Attach permanent label on each reel showing length, cable identification number, cable size, cable type, and date of manufacture. Provide water resistant label and the indelible writing on the labels. Apply end seals to each end of the cables to prevent moisture from entering the cable. Reels with cable shall be

suitable for outside storage conditions when temperature ranges from minus 40 degrees C to plus 65 degrees C, with relative humidity from 0 to 100 percent. Equipment, other than cable, delivered and placed in storage shall be stored with protection from weather, humidity and temperature variation, dirt and dust, or other contaminants in accordance with manufacturer's requirements.

1.8 MAINTENANCE

1.8.1 Record Documentation

Provide the activity responsible for telecommunications system maintenance and administration a single complete and accurate set of record documentation for the entire telecommunications system with respect to this project.

Provide T5 drawings including documentation on cables and termination hardware in accordance with EIA TIA/EIA-606-A. T5 drawings shall include schedules to show information for cut-overs and cable plant management, patch panel layouts, cross-connect information and connecting terminal layout as a minimum. T5 drawings shall be provided in hard copy format. Provide the following T5 drawing documentation as a minimum:

- a. Cables - A record of installed cable shall be provided in accordance with EIA TIA/EIA-606-A. The cable records shall include the required data fields for each cable and complete end-to-end circuit report for each complete circuit from the assigned outlet to the entry facility in accordance with EIA TIA/EIA-606-A. Include manufacture date of cable with submittal.
- b. Termination Hardware - Provide a record of installed patch panels, cross-connect points, campus distributor and terminating block arrangements and type in accordance with EIA TIA/EIA-606-A. Documentation shall include only the required data fields as a minimum in accordance with EIA TIA/EIA-606-A.

1.9 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Products supplied shall be specifically designed and manufactured for use with outside plant telecommunications systems.

2.2 TELECOMMUNICATIONS ENTRANCE FACILITY

2.2.1 Building Protector Assemblies

Provide self-contained unit supplied with a field cable stub factory connected to protector socket blocks to terminate and accept protector modules for 100 pairs of outside cable. Building protector assembly shall have interconnecting hardware for connection to interior cabling at full capacity. Provide manufacturers instructions for building protector assembly installation. Provide copper cable interconnecting hardware as specified in Section 16710, BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.2.2 Protector Modules

Provide in accordance with UL 497 three-electrode gas tube or solid state type 5 pin rated for the application. Provide gas tube protection modules in accordance with RUS Bul 345-83 and shall be heavy duty, $A > 10\text{kA}$, $B > 400$, $C > 65\text{A}$ where A is the maximum single impulse discharge current, B is the impulse life and C is the AC discharge current in accordance with NEMA C62.61. The gas modules shall shunt high voltage to ground, fail short, and be equipped with an external spark gap and heat coils in accordance with UL 497. Provide the number of surge protection modules equal to the number of pairs of exterior cable of the building protector assembly.

2.3 CLOSURES

2.3.1 Copper Conductor Closures

2.3.1.1 Underground Cable Closures

- a. In vault or manhole: Provide underground closure suitable to house a straight, butt, and branch splice in a protective housing into which can be poured an encapsulating compound. Closure shall be of suitable thermoplastic, thermoset, or stainless steel material supplying structural strength necessary to pass the mechanical and electrical requirements in a vault or manhole environment. Encapsulating compound shall be reenterable and shall not alter the chemical stability of the closure. Provide filled splice cases in accordance with RUS Bul 345-72.

2.4 CABLE SPLICES, AND CONNECTORS

2.4.1 Copper Cable Splices

Provide multipair, in-line splices of a moisture resistant, insulation displacement connector held rigidly in place to assure maximum continuity in accordance with RUS Bul 1753F-401. Cables greater than 25 pairs shall be spliced using multipair splicing connectors, which accommodate 25 pairs of conductors at a time. Provide correct connector size to accommodate the cable gauge of the supplied cable.

2.4.2 Copper Cable Splice Connector

Provide splice connectors with a polycarbonate body and cap and a tin-plated brass contact element. Connector shall accommodate 22 to 26 AWG solid wire with a maximum insulation diameter of 0.065 inch. Fill connector with sealant grease to make a moisture resistant connection, in accordance with RUS Bul 1753F-401.

2.4.3 Shield Connectors

Provide connectors with a stable, low-impedance electrical connection between the cable shield and the bonding conductor in accordance with RUS Bul 345-65.

2.5 CONDUIT

Provide conduit as specified in Section 16375A, ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

2.6 PLASTIC INSULATING TAPE

UL 510.

2.7 WIRE AND CABLE

2.7.1 Copper Conductor Cable

Solid copper conductors, covered with an extruded solid insulating compound. Insulated conductors shall be twisted into pairs which are then stranded or oscillated to form a cylindrical core. For special high frequency applications, the cable core shall be separated into compartments. Cable shall be completed by the application of a suitable core wrapping material, a corrugated copper or plastic coated aluminum shield, and an overall extruded jacket. Telecommunications contractor shall verify distances between splice points prior to ordering cable in specific cut lengths. Gauge of conductor shall determine the range of numbers of pairs specified; 19 gauge (6 to 400 pairs), 22 gauge (6 to 1200 pairs), 24 gauge (6 to 2100 pairs), and 26 gauge (6 to 3000 pairs). Copper conductor shall conform to the following:

2.7.1.1 Underground

Provide filled cable meeting the requirements of ICEA S-99-689 and RUS 1755.390.

2.7.1.2 Screen

Provide screen-compartmental core cable filled cable meeting the requirements of ICEA S-99-689 and RUS 1755.390.

2.7.2 Grounding and Bonding Conductors

Provide grounding and bonding conductors in accordance with RUS 1755.200, TIA J-STD-607-A, IEEE C2, and NFPA 70. Solid bare copper wire meeting the requirements of ASTM B 1 for sizes No. 8 AWG and smaller and stranded bare copper wire meeting the requirements of ASTM B 8, for sizes No. 6 AWG and larger. Insulated conductors shall have 600-volt, Type TW insulation meeting the requirements of UL 83.

2.8 T-SPAN LINE TREATMENT REPEATERS

Provide as indicated. Repeaters shall be pedestal mounted with

non-pressurized housings, sized as indicated and shall meet the requirements of RUS Bul 345-50.

2.9 CABLE TAGS IN MANHOLES, HANDHOLES, AND VAULTS

Provide tags for each telecommunications cable or wire located in manholes, handholes, and vaults. Cable tags shall be stainless steel and labeled in accordance with EIA TIA/EIA-606-A. Handwritten labeling is unacceptable.

2.9.1 Stainless Steel

Provide stainless steel, cable tags 1 5/8 inches in diameter 1/16 inch thick minimum, and circular in shape. Tags shall be die stamped with numbers, letters, and symbols not less than 0.25 inch high and approximately 0.015 inch deep in normal block style.

2.10 BURIED WARNING AND IDENTIFICATION TAPE

Provide fiber optic media marking and protection in accordance with EIA TIA/EIA-590-A. Provide color, type and depth of tape as specified in paragraph BURIED WARNING AND IDENTIFICATION TAPE in Section 02300, EARTHWORK.

2.11 GROUNDING BRAID

Provide grounding braid that provides low electrical impedance connections for dependable shield bonding in accordance with RUS 1755.200. Braid shall be made from flat tin-plated copper.

2.12 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.13 FIELD FABRICATED NAMEPLATES

Provide laminated plastic nameplates in accordance with ASTM D 709 for each patch panel, protector assembly, rack, cabinet and other equipment or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

PART 3 EXECUTION

3.1 INSTALLATION

Install all system components and appurtenances in accordance with manufacturer's instructions IEEE C2, NFPA 70, and as indicated. Provide all necessary interconnections, services, and adjustments required for a

complete and operable telecommunications system.

3.1.1.1 Contractor Damage

Promptly repair indicated utility lines or systems damaged during site preparation and construction. Damages to lines or systems not indicated, which are caused by Contractor operations, shall be treated as "Changes" under the terms of the Contract Clauses. When Contractor is advised in writing of the location of a nonindicated line or system, such notice shall provide that portion of the line or system with "indicated" status in determining liability for damages. In every event, immediately notify the Contracting Officer of damage.

3.1.1.2 Cable Inspection and Repair

Handle cable and wire provided in the construction of this project with care. Inspect cable reels for cuts, nicks or other damage. Damaged cable shall be replaced or repaired to the satisfaction of the Contracting Officer. Reel wraps shall remain intact on the reel until the cable is ready for placement.

3.1.1.3 Cable Protection

Provide direct burial cable protection in accordance with NFPA 70 and as specified in Section 16375A, ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Galvanized conduits which penetrate concrete (slabs, pavement, and walls) shall be PVC coated and shall extend from the first coupling or fitting outside either side of the concrete minimum of 6 inches per 12 inches burial depth beyond the edge of the surface where cable protection is required; all conduits shall be sealed on each end. Where additional protection is required, cable may be placed in galvanized iron pipe (GIP) sized on a maximum fill of 40% of cross-sectional area, or in concrete encased 4 inches PVC pipe. Conduit may be installed by jacking or trenching. Trenches shall be backfilled with earth and mechanically tamped at 6 inches lift so that the earth is restored to the same density, grade and vegetation as adjacent undisturbed material.

3.1.1.3.1 Cable End Caps

Cable ends shall be sealed at all times with coated heat shrinkable end caps. Cables ends shall be sealed when the cable is delivered to the job site, while the cable is stored and during installation of the cable. The caps shall remain in place until the cable is spliced or terminated. Sealing compounds and tape are not acceptable substitutes for heat shrinkable end caps. Cable which is not sealed in the specified manner at all times will be rejected.

3.1.1.4 Reconditioning of Surfaces

Provide reconditioning of surfaces as specified in Section 16375A, ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

3.1.1.5 Penetrations

Caulk and seal cable access penetrations in walls, ceilings and other parts of the building. Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings in accordance with Section 07840, FIRESTOPPING.

3.1.6 Cable Pulling

Test duct lines with a mandrel and swab out to remove foreign material before the pulling of cables. Avoid damage to cables in setting up pulling apparatus or in placing tools or hardware. Do not step on cables when entering or leaving the manhole. Do not place cables in ducts other than those shown without prior written approval of the Contracting Officer. Roll cable reels in the direction indicated by the arrows painted on the reel flanges. Set up cable reels on the same side of the manhole as the conduit section in which the cable is to be placed. Level the reel and bring into proper alignment with the conduit section so that the cable pays off from the top of the reel in a long smooth bend into the duct without twisting. Under no circumstances shall the cable be paid off from the bottom of a reel. Check the equipment set up prior to beginning the cable pulling to avoid an interruption once pulling has started. Use a cable feeder guide of suitable dimensions between cable reel and face of duct to protect cable and guide cable into the duct as it is paid off the reel. As cable is paid off the reel, lubricate and inspect cable for sheath defects.

When defects are noticed, stop pulling operations and notify the Contracting Officer to determine required corrective action. Cable pulling shall also be stopped when reel binds or does not pay off freely. Rectify cause of binding before resuming pulling operations. Provide cable lubricants recommended by the cable manufacturer. Avoid bends in cables of small radii and twists that might cause damage. Do not bend cable and wire in a radius less than 10 times the outside diameter of the cable or wire.

3.1.6.1 Cable Tensions

Obtain from the cable manufacturer and provide to the Contracting Officer, the maximum allowable pulling tension. This tension shall not be exceeded.

3.1.6.2 Pulling Eyes

Equip cables 1.25 inches in diameter and larger with cable manufacturer's factory installed pulling-in eyes. Provide cables with diameter smaller than 1.25 inches with heat shrinkable type end caps or seals on cable ends when using cable pulling grips. Rings to prevent grip from slipping shall not be beaten into the cable sheath. Use a swivel of 3/4 inch links between pulling-in eyes or grips and pulling strand.

3.1.6.3 Installation of Cables in Manholes, Handholes, and Vaults

Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support cables on brackets and cable insulators at a maximum of 4 feet. In existing manholes, handholes, and vaults where new ducts are to be terminated, or where new cables are to be installed, modify the existing installation of cables, cable supports, and grounding as required with

cables arranged and supported as specified for new cables. Identify each cable with corrosion-resistant embossed metal tags.

3.1.7 Cable Splicing

3.1.7.1 Copper Conductor Splices

Perform splicing in accordance with requirements of RUS Bul 1753F-401 except that direct buried splices and twisted and soldered splices are not allowed. Exception does not apply for pairs assigned for carrier application.

3.1.8 Surge Protection

All cables and conductors, except fiber optic cable, which serve as communication lines through off-premise lines, shall have surge protection installed at each end which meet the requirements of RUS Bul 1751F-815.

3.1.9 Grounding

Provide grounding and bonding in accordance with RUS 1755.200, TIA J-STD-607-A, IEEE C2, and NFPA 70. Ground exposed noncurrent carrying metallic parts of telephone equipment, cable sheaths, cable splices, and terminals.

3.1.9.1 Telecommunications Master Ground Bar (TMGB)

The TMGB is the hub of the basic telecommunications grounding system providing a common point of connection for ground from outside cable, CD, and equipment. Establish a TMGB for connection point for cable stub shields to connector blocks and CD protector assemblies as specified in Section 16402 INTERIOR DISTRIBUTION SYSTEMS.

3.1.9.2 Incoming Cable Shields

Shields shall not be bonded across the splice to the cable stubs. Ground shields of incoming cables in the EF Telecommunications to the TMGB.

3.1.9.3 Campus Distributor Grounding

- a. Protection assemblies: Mount CD protector assemblies directly on the telecommunications backboard. Connect assemblies mounted on each vertical frame with No. 6 AWG copper conductor to provide a low resistance path to TMGB.

3.1.10 Cut-Over

All necessary transfers and cut-overs, shall be accomplished by the telecommunications contractor.

3.2 LABELING

3.2.1 Labels

Provide labeling for new cabling and termination hardware located within the facility in accordance with EIA TIA/EIA-606-A. Handwritten labeling is unacceptable. Stenciled lettering for cable and termination hardware shall be provided using thermal ink transfer process.

3.2.2 Cable Tag Installation

Install cable tags for each telecommunications cable or wire located in manholes, handholes, and vaults including each splice. Tag only new wire and cable provided by this contract. The labeling of telecommunications cable tag identifiers shall be in accordance with EIA TIA/EIA-606-A. Do not provide handwritten letters. Install cable tags so that they are clearly visible without disturbing any cabling or wiring in the manholes, handholes, and vaults.

3.2.3 Termination Hardware

Label patch panels, distribution panels, connector blocks and protection modules using color coded labels with identifiers in accordance with EIA TIA/EIA-606-A.

3.3 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.4 FIELD QUALITY CONTROL

Provide the Contracting Officer 10 working days notice prior to each test. Provide labor, equipment, and incidentals required for testing. Correct defective material and workmanship disclosed as the results of the tests. Furnish a signed copy of the test results to the Contracting Officer within 3 working days after the tests for each segment of construction are completed. Perform testing as construction progresses and do not wait until all construction is complete before starting field tests.

3.4.1 Pre-Installation Tests

Perform the following tests on cable at the job site before it is removed from the cable reel. For cables with factory installed pulling eyes, these tests shall be performed at the factory and certified test results shall accompany the cable.

3.4.1.1 Cable Capacitance

Perform capacitance tests on at least 10 percent of the pairs within a cable to determine if cable capacitance is within the limits specified.

3.4.1.2 Loop Resistance

Perform DC-loop resistance on at least 10 percent of the pairs within a cable to determine if DC-loop resistance is within the manufacturer's calculated resistance.

3.4.1.3 Pre-Installation Test Results

Provide results of pre-installation tests to the Contracting Officer at least 5 working days before installation is to start. Results shall indicate reel number of the cable, manufacturer, size of cable, pairs tested, and recorded readings. When pre-installation tests indicate that cable does not meet specifications, remove cable from the job site.

3.4.2 Acceptance Tests

Perform acceptance testing in accordance with RUS Bul 1753F-201 and as further specified in this section. Provide personnel, equipment, instrumentation, and supplies necessary to perform required testing. Notification of any planned testing shall be given to the Contracting Officer at least 14 days prior to any test unless specified otherwise. Testing shall not proceed until after the Contractor has received written Contracting Officer's approval of the test plans as specified. Test plans shall define the tests required to ensure that the system meets technical, operational, and performance specifications. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested. Provide test reports in booklet form showing all field tests performed, upon completion and testing of the installed system. Measurements shall be tabulated on a pair by pair or strand by strand basis.

3.4.2.1 Copper Conductor Cable

Perform the following acceptance tests in accordance with EIA TIA/EIA-758:

- a. Wire map (pin to pin continuity)
- b. Continuity to remote end
- c. Crossed pairs
- d. Reversed pairs
- e. Split pairs
- f. Shorts between two or more conductors

3.4.3 Soil Density Tests

- a. Determine soil-density relationships as specified for soil tests in Section 02300, EARTHWORK.

-- End of Section --

SECTION 16713

FIBER OPTIC (FO) OUTSIDE PLANT (OSP) MEDIA

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA EIA/TIA-455-59	(1989) Measurement of Fiber Point Defects Using an OTDR
EIA EIA/TIA-455-78A	(1990; R 1998) Spectral-Attenuation Cutback Measurement for Single-Mode Optical Fibers
EIA TIA-758	(1999) Customer-owned Outside Plant Telecommunications Cabling Standard, including Addendum No. 1
EIA TIA/EIA-455-107A	(1999) Component Reflectance or Link/System Return Loss using a Loss Test Set
EIA TIA/EIA-455-B	(1998) Test Procedures for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components (ANSI)
EIA TIA/EIA-472D000-A	(1993) Fiber Optic Communications Cable for Outside Plant Use
EIA TIA/EIA-472DAAA	(1993) Detail Specification for All Dielectric Fiber Optic Communications Cable for Outside Plant Use Containing Class 1a 62.5 Um Core Diameter/125 um Cladding Diameter/250 um Coating Diameter Fiber(s).
EIA TIA/EIA-4750000-C	(1996) Generic Specifications for Fiber Optic Connectors (ANSI)
EIA TIA/EIA-526-14A	(1998) OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant (ANSI/TIA/EIA-526-14A)
EIA TIA/EIA-526-7	(1998) OFSTP-7 Measurement of Optical

Power Loss of Installed Single-Mode Fiber
Cable Plant (ANSI/TIA/EIA-526-7)

EIA TIA/EIA-568-B.1 (2001; Addendum 2001) Commercial Building
Telecommunications Cabling Standard - Part
1: General Requirements
(ANSI/TIA/EIA-568-B.1)

EIA TIA/EIA-568-B.3 (2000; Addendum 2002) Optical Fiber
Cabling Components Standard
(ANSI/TIA/EIA-568-B.3)

EIA TIA/EIA-569-A (1998; Addenda 2000, 2001) Commercial
Building Standards for Telecommunications
Pathways and Spaces (ANSI/TIA/EIA-569-A)

EIA TIA/EIA-590-A (1997) Standard for Physical Location and
Protection of Below Ground Fiber Optic
Cable Plant

EIA TIA/EIA-598-B (2001) Optical Fiber Cable Color Coding

EIA TIA/EIA-604-3A (2000) FOCIS 3 Fiber Optic Connector
Intermateability Standard - Standard Type
SC

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2002) National Electrical Safety Code

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-87-640 (1999) Fiber Optic Outside Plant
Communications Cable

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2003) Enclosures for Electrical Equipment
(1000 Volts Maximum)

NEMA RN 1 (1998) Polyvinyl Chloride (PVC) Externally
Coated Galvanized Rigid Steel Conduit and
Intermediate Metal Conduit

NEMA TC 2 (2003) Electrical Polyvinyl Chloride (PVC)
Tubing and Conduit

NEMA TC 3 (2004) Polyvinyl Chloride PVC Fittings for
Use with Rigid PVC Conduit and Tubing

NEMA TC 6 & 8 (2003) Polyvinyl Chloride PVC Plastic
Utilities Duct for Underground
Installations

NEMA TC 9 (2004) Fittings for Polyvinyl Chloride
(PVC) Plastic Utilities Duct for
Underground Installation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2005) National Electrical Code

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS 7CFR 1755.900 (2000) Filled Fiber Optic Cables (REA)

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-188-176 (Basic, Notice 1) Standardized Profile for
Asynchronous Transfer Mode (ATM)

MIL-STD-2042 (Rev B) Fiber Optic Cable Topology
Installation Standard Methods for Naval
Ships

1.2 RELATED REQUIREMENTS

Section 16050N BASIC ELECTRICAL MATERIALS AND METHODS applies to this section with additions and modifications specified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fiber Optic System; G

SD-03 Product Data

Fiber Optic Media Types; G

Fiber Optic Splices Material Data; G

Fiber Optic Terminations and Connectors Material Data; G

Fiber Optic Enclosures; G

SD-06 Test Reports

Fiber Optic Factory Test Plan; G

Fiber Optic Field Tests Plan; G

SD-07 Certificates

Fiber Optic Cable Installer and Splicer Qualifications; G

Manufacturer's qualifications; G

SD-08 Manufacturer's Instructions

Fiber optic system instructions; G

1.4 QUALITY ASSURANCE

1.4.1 Fiber Optic System

Provide drawings for the fiber optic cable and pathway system. Provide single line schematic details of the fiber optic and pathway media, splices, and associated construction materials. Drawings shall be in AUTOCAD.DXF or compatible format. Provide Registered Communications Distribution Designer (RCDD) approved drawings of the fiber optic system. Include drawing details of fiber optic terminations in equipment rooms. System drawings shall show final configuration, including location, fiber pair count, pathway innerduct arrangement, and pathway assignment of outside plant. FO system shall be compatible with MIL-STD-188-176. Pier FO systems shall be designed for compatibility with MIL-STD-2042 and NAVSEA drawings.

1.4.2 Fiber Optic Cable Installer and Splicer Qualifications

Technicians installing FO media, splices and performing system tests shall be certified and trained in accordance with an approved manufacturers training program. Technicians shall have a minimum of 3 years FO experience in installing equivalent FO systems. Submit data for approval to the Contracting Officer. Submit FO technician qualifications for approval 30 days before splices are to be made on the cable. Certification shall include the training, and experience of the individual on specific type and classification of FO media to be provided under this contract.

1.4.3 Fiber Optic System Instructions

Provide installation methods and procedures for installing the FO media and pathway system. Include methods and procedures for installing FO media, pathway, splices, and associated hardware. Submit installation procedures and equipment list to the Contracting Officer.

1.4.4 Manufacturer's Qualifications

The FO media manufacturer shall have a minimum of 3 years experience in the manufacturing, assembly, and factory testing of FO media which comply with RUS 7CFR 1755.900. Manufacturer must provide a list of customers with 3 years of maintenance logs documenting experience with government customers.

1.4.5 Fiber Optic Factory Test Plan

Prepare and provide the government for review a test plan for factory and field tests of the FO media. Provide factory OTDR test data as part of the test report. Provide a list of factory test equipment. Include a FO link performance test plan. Submit the plan at least 30 days prior to tests for government approval. Refer to EIA TIA/EIA-569-A for performance measurement criteria. Conduct tests at all operating bandwidths. Provide calculations for optical power budget and bandwidth as required by RUS 7CFR 1755.900 using test method EIA EIA/TIA-455-78A or EIA TIA/EIA-455-B. Submit test plans and reports to the government for review and approval.

1.4.6 Fiber Optic Field Tests Plan

Prepare and provide technicians and test equipment for field tests of FO media. Conduct OTDR reel tests at the job site prior to installation. Perform OTDR and end to end tests of all installed media. Conduct tests on single mode fiber in accordance with EIA TIA/EIA-526-7 for single mode fiber and EIA TIA/EIA-526-14A for multi mode fiber.

1.5 DELIVERY, STORAGE, AND HANDLING

Ship media to job site on factory reels or in factory cartons. Radius of the reel drum shall not be smaller than the minimum bend radius recommended by the manufacturer for the media. Wind cable on the reel so that unwinding can be done without kinking the cable. Two meters of cable at each end of the reel must be readily accessible for testing. Provide a permanent label on each reel showing length, media, identification number, and date of manufacture. Provide water resistant label and ink on the labels. Apply end seals to each end of the media after testing and before terminating to prevent moisture from entering the cable while stored at the job site. Reels with cable shall be suitable for outside storage conditions when temperature ranges from minus 40 degrees C to plus 65 degrees C, with relative humidity from zero to 100 percent. Equipment, other than FO media, delivered and placed in storage shall be stored with protection from weather, humidity and temperature variation, dirt and dust, or other contaminants.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and FO system material shall be the standard products of a manufacturer regularly engaged in the manufacturer of such products and shall be the manufacturer's standard commercially available product.

2.1.1 Fiber Optic Media Types

FO media shall meet all performance requirements of EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.3 and the physical requirements of ICEA S-87-640 and EIA TIA/EIA-598-B.

2.1.1.1 Multi Mode Fiber Media

Provide FO media with outer sheath jacket, kevlar strength member, ripcords, water blocking material, optional steel shield, core tube, and

core fibers as installed in a permanent underground pathway system as shown on the construction drawings. FO media shall have an all glass, graded index material with a nominal core diameter of 62.5 microns. Provide a cladding material for the fiber which is compatible with the core. Media transmission window shall be centered at 850 and 1300 nanometer wavelengths, attenuation at 850 nanometers shall be less than 4.0 dB per kilometer. Minimum bandwidth shall be 500 MHz-Km.

2.1.1.2 Single Mode Fiber Media.

Provide FO single mode media with outer sheath jacket, kevlar strength member, ripcords, water blocking material, optional steel shield, core tube, and core fibers as installed in a permanent underground pathway system as shown on the construction drawings. Media shall have all glass, dual window, graded index material with a core diameter of 8.7 microns. Fiber shall be coated with a cladding material which is concentric with the core. Fiber cladding diameter shall be nominal 125 microns. Media shall have a transmission window centered at 1300 and 1550 nanometer wavelengths, attenuation at 1550 nanometers shall be less than 0.5 dB per kilometer. FO media shall comply with EIA TIA/EIA-472DAAA, and EIA TIA-758.

2.2 FIBER OPTIC SPLICES

Provide FO splices and splicing materials for fusion or mechanical methods as allowed by base comm group at locations shown on the construction drawings. The splice insertion loss shall be less than 0.1 dB mean, (0.3 dB max) when measured in accordance with EIA EIA/TIA-455-59 using an Optical Time Domain Reflectometer (OTDR). Splices shall be designed for a return loss of 40.0 db max for single mode fiber when tested in accordance with EIA TIA/EIA-455-107A.

2.3 FIBER OPTIC ENCLOSURES

Provide metallic enclosures for fiber optic data transmission equipment. NEMA 250, type 4 enclosure. Enclosures shall protect the spliced fibers from moisture and physical damage. Splice closure shall provide strain relief for the cable and the fibers at splice points. Provide full documentation citing conformance to structural parameters.

2.4 FIBER OPTIC TERMINATIONS AND CONNECTORS

FO connectors shall comply with EIA TIA/EIA-4750000-C and EIA TIA/EIA-604-3A.

2.5 FIBER OPTIC PATHWAY SYSTEM

Provide an FO pathway system including raceway conduit, duct system, and maintenance manholes and handholes as shown on the drawings. Pathway materials shall comply with EIA TIA/EIA-569-A, and the following commercial standards for construction materials, NEMA RN 1 (PVC), NEMA TC 2 (PVC), NEMA TC 3 (PVC), NEMA TC 6 & 8, and NEMA TC 9.

2.5.1 Conduit

Conduit as specified in Section 16302N, "Underground Transmission and

Distribution."

2.6 FACTORY FO QUALITY CONTROL

Conduct factory quality tests of FO media as required by EIA TIA/EIA-472D000-A.

2.7 PREPARATION FOR DELIVERY

Ship media on reels in 1200 ft lengths. Provide 6 1/2 feet pigtails on each end of media accessible for testing. Reel drum shall comply with manufacturers recommended bend radius for the media. Wind media on reel so that unreeling can be done without kinking the media. Attach a permanent waterproof label with indelible text on reel showing the length, media type, bandwidth, attenuation, and date of manufacture. Contractor shall verify prior to ordering that length is sufficient to run from manhole to building telecomm room without splices.

2.8 FACTORY REEL TEST

Test 100 percent OTDR test of FO media at the factory prior to shipment in accordance with EIA TIA/EIA-568-B.1 and EIA TIA/EIA-568-B.3. Use EIA TIA/EIA-526-7 for single mode fiber and EIA TIA/EIA-526-14A Method B for multi mode fiber measurements. Calibrate OTDR to show anomalies of 0.2 dB minimum. Provide digitized or photographic traces to the Contracting Officer.

2.9 MISCELLANEOUS ITEMS

2.9.1 FO Media Tags

Provide stainless steel, 1 5/8 inches in diameter 1/16 inch thick, and circular in shape.

2.9.2 Buried Warning and Identification Tape

Provide color, type and depth of tape as specified in paragraph "Buried Warning and Identification Tape" in Section 02300 EARTHWORK, FO media must be marked and protected as required by EIA TIA/EIA-590-A.

2.9.3 Grounding Braid

Grounding braid shall provide low electrical impedance connections for dependable shield bonding. Braid shall be made from flat tin-plated copper.

PART 3 EXECUTION

3.1 INSTALLATION

Install and test the FO media in accordance with contract drawings, specifications, IEEE C2, NFPA 70, and EIA TIA/EIA-590-A. Provide all necessary power, utility services, technicians, test equipment, calibration equipment as required to perform reel and final acceptance tests of the media. All media which fail the factory or reel tests or final acceptance

field tests shall be replaced and re-tested at the contractors expense. Splices are not permitted unless shown on the construction drawings. Field test splices within 24 hours after splice installation. Splices shall be tested to demonstrate a maximum 0.2 dB loss. Provide a splice box for each field splice. Provide a minimum of 2 meters for routing and testing media. Protect media ends of unspliced FO media during splicing operations.

3.1.1 Contractor Damage

Promptly repair indicated utility and communications lines or systems damaged during site preparation and construction. Damage to lines or systems not indicated, which are caused by contractor operations, shall be treated as "Changes" under the terms of the Contract clauses. When Contractor is advised in writing of the location of a non-indicated line or system, such notice shall provide that portion of the line or system with "indicated" status in determining liability for damages. In every event, immediately notify the Contracting Officer of damage.

3.1.2 Underground Duct

Construct underground duct as specified.

3.1.2.1 Connections to Existing Maintenance Holes [and Handholes]

For duct line connections to existing structures, break the structure wall out to the dimensions required and preserve the steel in the structure wall. Cut the steel and the duct line envelope.

3.1.2.2 Connections to Existing Ducts

Where connections to existing duct lines are indicated, excavate the lines to the maximum depth required. Cut off lines and remove loose concrete from the conduits before new concrete encased ducts are installed. Provide reinforced concrete collar, poured monolithically with the new duct line to take the shear at the joint of the duct lines.

3.1.3 Reconditioning of Surfaces

3.1.3.1 Unpaved Surface Treatment

Restore unpaved surfaces disturbed during the installation of duct or direct burial cable to their original elevation and condition. Carefully preserve existing sod and topsoil and replace after the back-filling is completed. Replace damaged sod with sod of quality equal to that removed. Where the surface is disturbed in a newly seeded area, re-seed the restored surface with the same quantity and formula of seed as that used in the original seeding.

3.1.3.2 Paving Repairs

a. Where trenches, pits, or other excavations are made in existing roadways and in other areas of pavement where surface treatment of any kind exists, restore such surface treatment or pavement to the same thickness and to the same kind as previously existed. Surface treatment or pavement

shall also match and tie into the adjacent and surrounding existing surfaces.

3.1.4 Cable Pulling

Test duct lines with a mandrel and swab out to remove foreign material before the pulling of FO media. Avoid damage to cables in setting up pulling apparatus or in placing tools or hardware. Do not step on media when entering or leaving the maintenance holes. Do not place media in ducts other than those shown without prior written approval of the Contracting Officer. Roll cable reels in the direction indicated by the arrows painted on the reel flanges. Set up media reels on the same side of the maintenance hole as the pathway section in which the media is to be placed. Level the reel and bring into proper alignment with the pathway section so that the media pays off from the top of the reel in a long smooth bend into the duct without twisting. Under no circumstances shall the media be paid off from the bottom of the reel. Check the equipment set up prior to beginning the media cable pulling to avoid an interruption once pulling has started. Use a cable feeder guide of suitable dimensions between media reel and face of duct to protect media and guide cable into the duct as it is paid off the reel. As media is paid off the reel, lubricate and inspect media for sheath defects. When defects are noticed, stop pulling operations and notify the Contracting Officer to determine required corrective action. Stop media pulling if reel binds or does not pay off freely. Rectify cause of binding before resuming pulling operations. Provide media lubricants recommended by the cable manufacturer. Provide 3.3 feet of spare media in all manholes and enclosures for final termination and testing.

3.1.4.1 FO Media Tensions

Install FO media as shown on construction drawings. Provide devices to monitor media tension during installation. Do not exceed manufacturers recommended maximum FO tensions and bending radii during installation.

3.1.4.2 Pulling Eyes

Equip media 1- 1/4 inches in diameter and larger with cable manufacturer's factory installed pulling-in eyes. Provide media with diameter smaller than 1-1/4 inches with heat shrinkable type end caps or seals on cable ends when using cable pulling grips. Rings to prevent grip from slipping shall not be beaten into the cable sheath. Use a swivel grip of 3/4 inch links between pulling-in eyes or grips and pulling strand.

3.1.4.3 Installation of Media in Maintenance Manholes, Handholes, and Vaults

Do not install media utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support media on brackets and cable insulators at a maximum of 4 feet. In existing maintenance manholes, handholes, and vaults where new ducts are to be terminated, or where new media are to be installed, modify the existing installation of media, cable supports, and grounding as required with cables arranged and supported as specified for new media.

3.1.5 Grounding

Ground exposed non current carrying metallic parts of telephone equipment, media sheaths, media splices, and terminals.

3.1.6 Housekeeping

The Contractor shall be responsible for cleaning up work area and maintaining the work area in orderly condition.

3.2 FIELD QUALITY CONTROL

Provide the Contracting Officer 10 working days notice prior to each reel and final acceptance test. Provide labor, equipment, and incidentals required for testing. Correct defective material and workmanship disclosed as the results of the tests. Furnish a signed copy of the test results to the Contracting Officer within 3 working days after the tests for each segment of construction are completed. Perform testing as construction progresses and do not wait until all construction is complete before starting field tests.

3.2.1 Field Reel Tests

Perform the following tests on FO media at the job site before it is removed from the cable reel. For cables with factory installed pulling eyes, these tests shall be performed at the factory and certified test results shall accompany the media. Perform OTDR tests with media on reels and compare factory and field test data.

3.2.1.1 Reel Test Results

Provide results of reel tests to the Contracting Officer at least 5 working days before installation is to commence. Results shall indicate reel number of the media, manufacturer, type and number of fiber tested, and recorded readings. When reel tests indicate that the media does not comply with factory reel test results remove the media from the job site and replace with compliant media.

3.2.2 Final Acceptance Tests

Perform end-to-end tests including power meter light source and OTDR tests.

Perform OTDR measurements as required by EIA TIA/EIA-568-B.1 and EIA TIA/EIA-568-B.3. Single mode fiber shall be tested in accordance with EIA TIA/EIA-526-7 (Optical Power Loss). Multi mode fiber shall be tested in accordance with EIA TIA/EIA-526-14A (Optical Power Loss).

3.2.2.1 Test Results

Provide results of final acceptance tests (attenuation tests, OTDR traces, etc.), to the Contracting Officer at least 5 working days after completion of tests.

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SECTION 16815

CABLE TELEVISION PREMISES DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70

(2002) National Electrical Code

1.2 SYSTEM DESCRIPTION

The cable television premises distribution system shall consist of coaxial cables and connecting hardware to transport television signals throughout the building to user locations as indicated.

1.3 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, non-condensing.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Cable Television Premises Distribution System; G.

Detail drawings including a complete list of equipment and material. Detail drawings shall contain complete wiring and schematic diagrams and other details required to demonstrate that the system has been coordinated and will function properly as a system. Drawings shall include vertical riser diagrams, equipment rack and panel details, elevation drawings of telecommunications closet walls, outlet face plate details for each outlet configuration, and descriptions and types of cables, conduits, and cable trays, if used. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation.

Installation; G.

Record drawings for the installed cable system. The drawings shall show the locations of cable terminations, including outlets, and location and routing of cables. The identifier for each termination and cable shall appear on the drawings.

SD-03 Product Data

Spare Parts.

Lists of spare parts, tools, and test equipment for each different item of material and equipment specified, after approval of detail drawings, not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of spare parts recommended for stocking.

Manufacturer's Recommendations; G.

Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be provided prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received and approved.

SD-07 Certificates

Materials and Equipment

Where materials or equipment are specified to conform, be constructed or tested to meet specific requirements, certification that the items provided conform to such requirements. Certification by a nationally recognized testing laboratory that a representative sample has been tested to meet the requirements, or a published catalog specification statement to the effect that the item meets the referenced standard, is acceptable as evidence that the item conforms. Compliance with these requirements does not relieve the Contractor from compliance with other requirements of the specifications.

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

Commercial, off-the-shelf manuals for operation, installation, configuration, and maintenance of products provided as a part of the cable television premises distribution system. Specification sheets for cable, connectors, and other equipment shall be provided.

1.5 QUALIFICATIONS

1.5.1 Minimum Contractor Qualifications

Work under this section shall be performed, and equipment shall be furnished and installed, by a qualified Contractor as defined herein. The Contractor shall have a minimum of two years of experience in the installation and testing of coaxial cable-based TV distribution systems and equipment. Installers assigned to the installation of this system or its components shall have a minimum of two years of experience in the installation of the specified coaxial cable and components.

1.5.2 Minimum Manufacturer Qualifications

The equipment and hardware provided under this contract shall be products of manufacturers that have a minimum of two years of experience in producing the types of systems and equipment specified.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust or other contaminants.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least one year prior to installation. Materials and equipment shall conform to the respective publications and other requirements specified below and to the applicable requirements of NFPA 70.

2.1.1 COAXIAL CABLE

Coaxial cable shall be RG-6/U, quad shield. Cable shall be label-verified.

Cable jacket shall be factory marked at regular intervals identifying cable type. Cable shall be rated CMP per NFPA 70. Interconnecting cables shall be cable assemblies consisting of RG-6/U coaxial cable with male connectors at each end, provided in lengths determined by equipment locations as shown.

2.1.2 Outlets

Cable television outlets, including wall outlet plates, shall be equipped with a female connector to accept the connecting coaxial cable from the user's television set. Faceplates provided shall be ivory impact resistant plastic.

2.1.3 OUTLET BOXES

Electrical boxes for cable television outlets shall be 4-11/16 inch square by 2-1/8 inches deep with minimum 3/8 inch deep single or two gang plaster

ring as shown. Conduits shall be minimum 1 inch.

PART 3 EXECUTION

3.1 INSTALLATION

System components and appurtenances shall be installed in accordance with NFPA 70, manufacturer's instructions and as shown. Necessary interconnections, services, and adjustments required for a complete cable television distribution system, ready to connect to external television signal sources, shall be provided. Penetrations in fire-rated construction shall be firestopped in accordance with Section 07840 FIRESTOPPING. Conduits, outlets, raceways, and wiring shall be installed in accordance with Section 16402 INTERIOR DISTRIBUTION SYSTEM. Cables and outlets shall be individually labeled and marked. Cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with ac power cables. Cables not installed in conduit or wireways shall be properly secured and neat in appearance and, if installed in plenums or other spaces used for environmental air, shall comply with NFPA 70 requirements for this type of installation.

3.1.1 Horizontal Cable Installation

The rated cable pulling tension shall not be exceeded. Cable shall not be stressed such that twisting, stretching or kinking occurs. Cable shall not be spliced. Cable not in a wireway shall be suspended a minimum of 8 inches above ceilings by cable supports no greater than 48 inches apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided. Cables shall be terminated unless shown otherwise. Minimum bending radius shall not be exceeded during installation or once installed. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered.

3.1.2 Outlets

3.1.2.1 Faceplates

Each faceplate shall be labeled with its function and a unique number to identify the cable run.

3.1.2.2 Cables

Cables shall have a minimum of 6 inches of slack cable loosely coiled into the cable television outlet boxes. Minimum manufacturer's bend radius shall not be exceeded.

3.1.2.3 Pull Cords

Pull cords shall be installed in conduits serving the cable television premises distribution system which do not initially have cable installed.

3.2 TERMINATIONS

Cables and conductors shall sweep into termination areas; cables and conductors shall not bend at right angles. Manufacturer's minimum bending radius shall not be exceeded. Coaxial cables shall be terminated with appropriate connectors as required. Cable shield conductor shall be grounded to communications ground at only one point and shall not make electrical contact with ground anywhere else.

3.3 GROUNDING

The cable television distribution system ground shall be installed in the cable television entrance facility and in any auxiliary closet identified in Section 16402 INTERIOR DISTRIBUTION SYSTEM or otherwise indicated. Equipment racks shall be connected to the electrical safety ground.

3.4 LABELING

Cables shall be labeled on both ends with circuit number, room number, or other appropriate marking allowing for correct identification of the cable and its destination.

3.5 TESTING

Materials and documentation to be furnished under this specification are subject to inspections and tests. Components shall be terminated prior to testing. Equipment and systems will not be accepted until the required inspections and tests have been made, demonstrating that the cable television premises distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided. After installation of the cable and before connecting system components, each cable section shall be end-to-end tested using a time domain reflectometer (TDR) to determine shorts, opens, kinks, and other impedance discontinuities and their locations. Cable sections showing adverse impedance discontinuities (greater than 6 dB loss) shall be replaced at the Contractor's expense. There shall be no cable splices between system components unless approved by the Government.

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